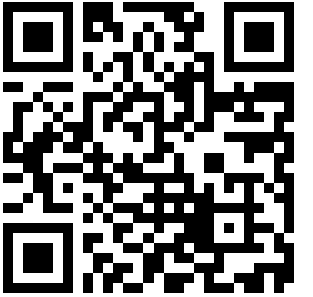
The Weir Frog Co.

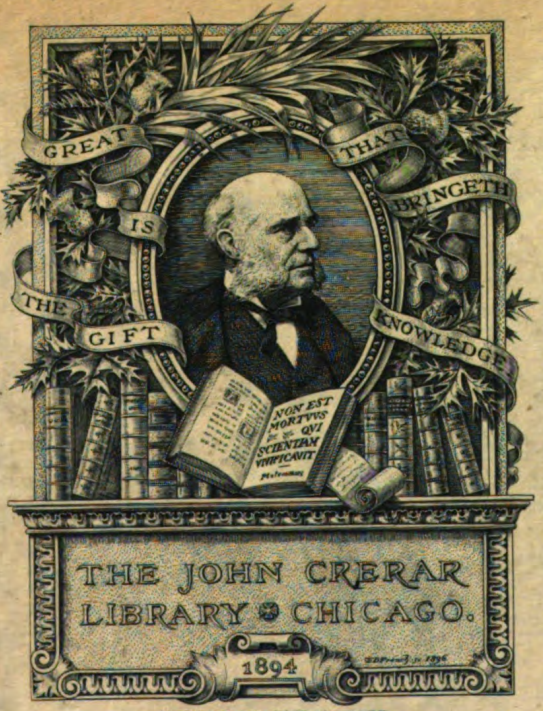
MANUFACTURERS OF

Frogs, Switches, Crossings, Etc.

CINCINNATI, OHIO.

1893.





PRESENTED BY

The Railway Age.

CATALOGUE No. 8.

THE WEIR FROG CO.

MANUFACTURERS OF

FROGS, SWITCHES, CROSSINGS,

AND ALL KINDS OF REGULAR AND INTRICATE TRACK WORK
AND MATERIAL FOR STEAM RAILROADS, ELECTRIC ROADS, CABLE ROADS, HORSE-CAR LINES,
AND LIGHT-RAIL PORTABLE TRACK WORK FOR MINES,
CONTRACTORS, PLANTATIONS, ETC.

OFFICE AND WORKS:

FRONT, SMITH, AND WATER STREETS, CINCINNATI, OHIO, U. S. A.

FRED C. WEIR, PRESIDENT.

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YEATS & GIBSON,
No. 80 La Salle Street, Chicago, Ills.

H. C. McNAIR,
Endicott Building, St. Paul, Minn.

1893.

CONTENTS.

TO OUR PATRONS.

PLEASE read carefully our instructions for ordering material; it will save considerable time in getting out your work if we can get all the information required at once. If there is anything you want to know about our Manufactures, first read what we say about them in this Catalogue, and if you don't find all the information you want here, write us, and we will cheerfully answer your questions.

As we are still making improvements in track material, we wish to call your attention to the additions this year in our Catalogue No. 3.

First: We show the method of joining Steel Plates to our Standard Fixed Frog, page 17.

Second: An improved arrangement of plates in our Standard Spring Frog, Design 2, page 25.

Third: A new design of Spring-Rail Frog with a Hinged Wing Rail, pages 40–43.

Fourth: A Combination Crossing with Movable Frog Points, operated by two Stands, pages 64–67.
Sixth: A Ground-Throw Stand with adjustable Throw for Combination Crossings.
Seventh: An additional cut of our Standard Electric-Road Crossing, angle 45°, page 75.
Eighth: A new design of Electric-Road Crossing, page 77.
Ninth: Two new designs of Reenforced Switches with adjustable Head-Rod, pages 88 and 92.
Tenth: Three designs of Derailing Safety Switches for side tracks, pages 151, 153, and 155.
Eleventh: Illustrations of our solid Cast-Steel Switches and Mates for Street Railways.
Twelfth: A new T Rail Frog without Guard for Street Railways, page 175.
Thirteenth: Illustrations of nineteen different diagrams of Street Railway Special Work, pages 188 to 203.

The tables at the back of the book have been corrected and increased. Many of them are entirely original, and it is hoped that they will be of use to some of our friends. In connection with this, please read the explanation of Tables, pages 210 and 211.

Permit us to thank you for the favors shown in the past, and to repeat that the reputation which we have acquired for prompt shipment we propose to maintain, and our capacity, which we are constantly increasing, is still the largest of any concern west of the Alleghany Mountains.

INSTRUCTIONS FOR ORDERING MATERIAL.

WE require the following information in order to manufacture supplies properly, and if these instructions are rigidly followed, and the information correctly given, we will guarantee our work to be satisfactory.

Always refer to the number of page and figure in this Catalogue, which illustrates or describes what is wanted.

FROGS: Angle or number, length over all, and length of main point; height and weight of rail, and, if convenient, the name of the mill which rolled the rail, and also the rail-section number, spacing of splice-bar holes, *i. e.*, the distance of center of first hole from end of rail, and distance between center of first and center of second holes. If six-hole angle bar is used, we will want also distance from center of second to center of third holes. If steel plates are wanted, specify those.

SPRING FROGS: All the information required for Fixed Frogs, and also whether they are for right-hand or left-hand turnouts. Designate which design is preferred, giving number of page and figure in this Catalogue.

CROSSINGS: Angle between intersection of tracks, gauge of each track (if different gauges, send plan showing which way they cross). If either track is curved, send plan showing which track is curved, and also direction and amount of curve. The angle of Crossings on curves should be given between the *tangents at the intersection of center lines*. Give height and weight of the rail of each road, also spacing of splice-bar holes for each rail. (See Frogs.) Give number of page and figure which shows style of Crossing desired.

We always make our Crossings uniformly of the heaviest rail used where the Crossing is to be put in, because it makes a more substantial piece of work. To join the heavy rail to the light one, offset fish-plates and steel-plate step-chairs should be used. We will furnish these if ordered.

SPLIT SWITCHES: Length of point rails, gauge of track, height and weight of rail, spacing of splice-bar holes, and throw of Stand which will be used with the Switch, diameter of hole in end of head-rod, when the connecting-rod of Stand is attached Refer to number of page and figure for design wanted.

SWITCH STANDS: All of our Stands are made with a five-inch throw, unless otherwise ordered, and we furnish a connecting-rod with each Stand. These rods are forked (Fig. 52, page 125) to fit over head-rod ¾″ thick, and are drilled for a ⅞″ pin. If you have a standard Target and Lamp fitting, send us a drawing of them, and we will equip your Stands with them. Give number of figure and page in this Catalogue which illustrates the Stand wanted.

HEAD-CHAIRS: Drawing of rail used, or width of head and base, throw of Switch-Stand, and whether for Single or Three-Throw Turnouts.

RAIL-BRACES: Section of rail and design number, referring to number of figure and page in this Catalogue.

TIE-BARS: (Stub Switches) Drawing of rail used, or width of head and base, gauge of track.

BRIDGE-GUARD: Height and weight of rail, and gauge of track.

EXPANSION JOINT: Height and weight of rail.

STREET-RAILWAY WORK: Indicate what is wanted by referring to the figure numbers of the diagrams of special track work in this Catalogue. If not shown by any of these figures, send a plan of the work. Give us the section of guard and tram rail used, and the drilling at the end of the rails; also gauge of track, distance between track centers, radius of curve, width of each street from curb to curb, and mark the direction of traffic on the plan.

Please read what we say about special work on page 188.

FROG POINT CONSTRUCTION.

Before we show our Frogs we wish to call your attention to the construction of Frog Points, or the methods of jointing the point-rails of Frogs.

Cut of cross section, No. 1, shows original method of making points of Frogs, by notching the main-point rail to receive short-point rail. Cut No. 2 shows the first improvement on this, by which the head of the main-point rail was preserved, but the base weakened. Cut No. 3 shows the full strength of the main-point rail preserved, but at the cost of very materially weakening the short-point rail, so that it has a very slim vertical support. Cut No. 4 shows the latest improvement, which is the WEIR system, manufactured and controlled exclusively by us. This is what we term our Die-Formed Short Point. By this method we not only save the full strength of the main-point rail, but more of the original strength of the short-point rail, and produce a stronger construction of the point rails generally.

These cross-section cuts are fair illustrations, photographed down from full-sized drawings, therefore they can be unhesitatedly accepted as correct.

FROG-POINT CONSTRUCTION.

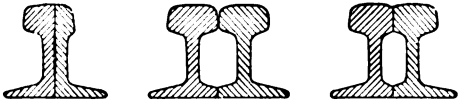


Fig. 1.

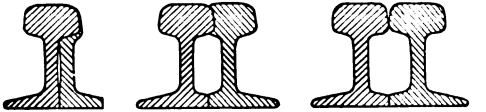


Fig. 2.

F. C. WEIR'S PATENT.

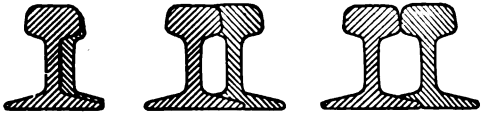


Fig. 3.

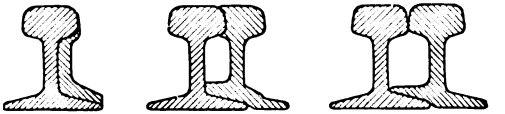


Fig. 4.

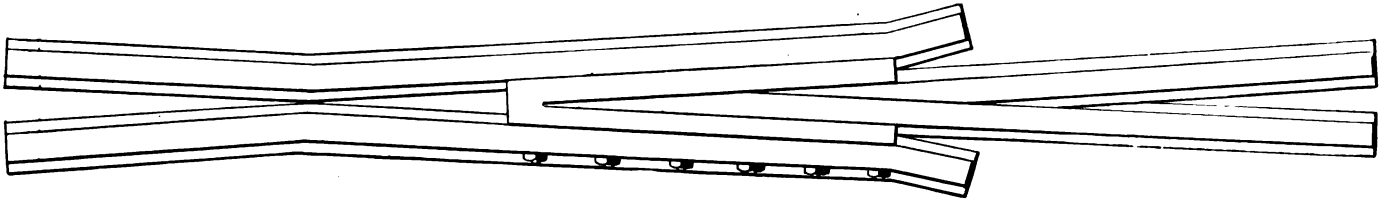
THE WEIR BOLTED STIFF FROG.

Fig. 5 shows plan and cross sections of our Standard Stiff Frog, constructed with our specially rolled wrought-iron or steel filling, which perfectly fits the section of rail under the head and on the base in the same way that an angle bar does. It will be seen that the Weir Patented Point Construction is used, and attention is also called to the superior method of bolting these Frogs. We use 7/8" bolts, made of the very best iron, the National Nut Lock, made especially for us, 5/8" wide. Since we commenced the use of this Nut Lock we have never known such a thing as loose bolts. You will notice that we are using three bolts through the short point, besides those in front. When we make Frogs of very heavy rail we use 1" bolts of the best quality of iron, and 1" National Nut Locks 3/4" wide, in order to make the Frog proportionally strong to the rest of the track.

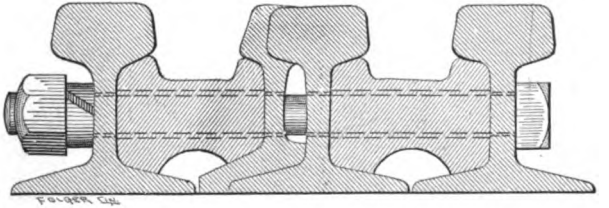
We make our Frogs with a 3/8" actual point; by so doing we are able to get the point nearer the wing rails, hence the wheel is not as apt to cut them out.

THE WEIR BOLTED STIFF FROG.

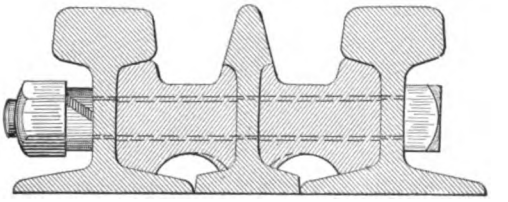
Fig. 5.



SECTION OF RAILS 1 FT. 10 IN. FROM END OF POINT RAIL.



SECTION OF RAILS AT END OF POINT RAIL.



PATENTED.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

THE WEIR BOLTED STIFF FROG.

WITH F. C. WEIR'S PATENTED STEEL FILLING.

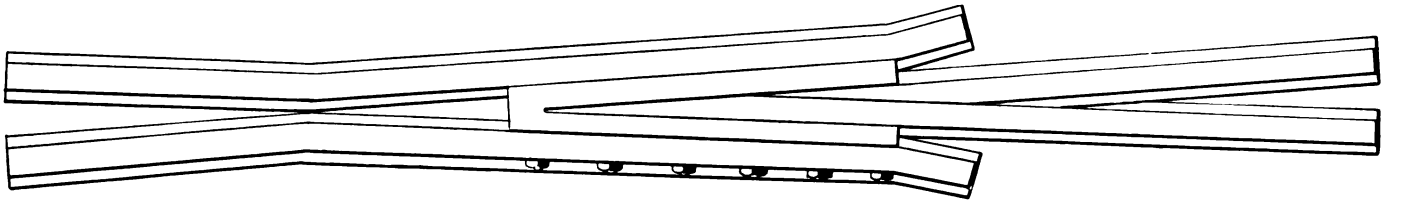
We wish to call your attention especially to the new steel filling material, shown by the cross sections of the Frog (Fig. 6).

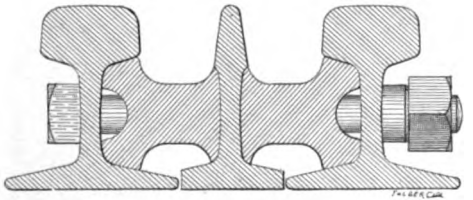
The shape is such that the material is in the place where it best resists the strain to which the Frog is subjected, and, furthermore, the liability to shear the bolts is reduced to a minimum by reason of the grooves in the side, which give a clearance between rail and filling material. By the use of this we reduce the weight of the Frog, but preserve all its durability, while its elasticity is increased.

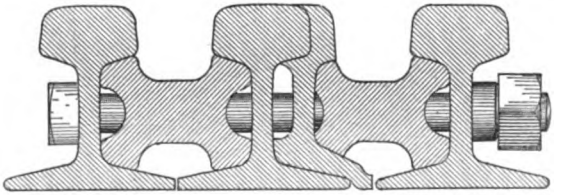
THE WEIR BOLTED FROG.

WITH F. C. WEIR'S PATENTED STEEL FILLINGS.

Fig. 6.







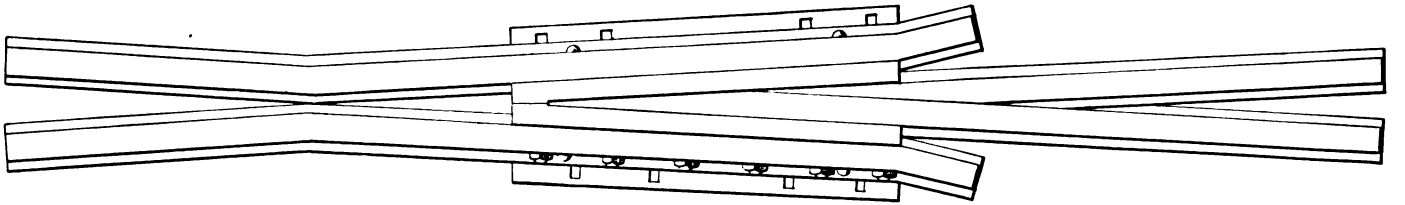
FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

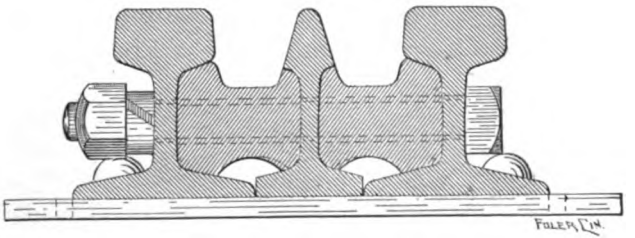
THE WEIR BOLTED STIFF FROG ON STEEL PLATE.

This shows one of our Standard Stiff Frogs as shown by Fig. 5, Page 13, with the addition of a half-inch steel base-plate under the point. This plate is riveted to the base of the wing rails, and spike-holes are punched close to the outer edge of the base to permit spiking to the ties. The plate prevents the point rail cutting into the ties, and very materially increases the life of the Frog.

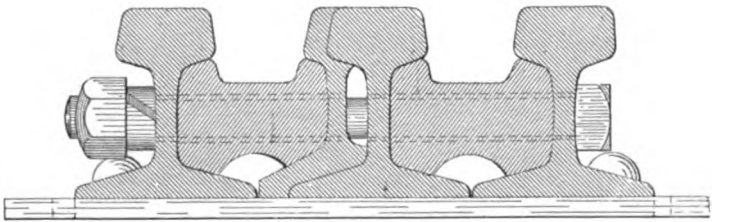
THE WEIR BOLTED STIFF FROG ON STEEL PLATE.

Fig. 105.





SECTION AT END OF POINT.



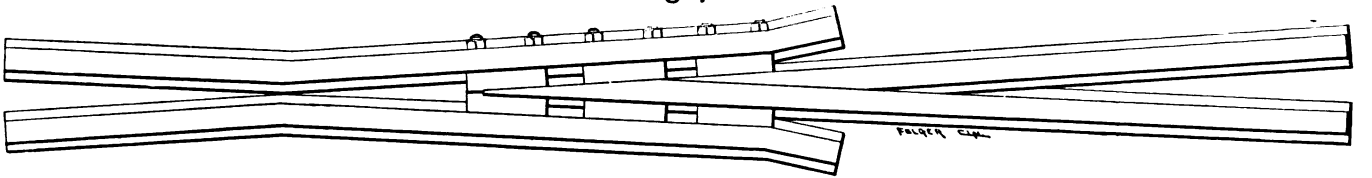
SECTION OF RAIL 1′ 10″ FROM POINT.

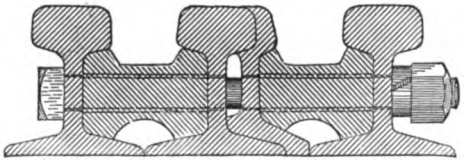
BOLTED FROG WITH CAST-IRON FILLING BLOCKS.

We show by Fig. 7 a plan and section of Stiff Frog with cast-iron filling. These Blocks are the same general shape as our wrought-iron filling material, but in short lengths. The only advantage of a Frog with this kind of filling is that its first cost is less than with steel or wrought-iron filled Frogs.

BOLTED FROG WITH CAST-IRON FILLING BLOCKS.

Fig. 7.





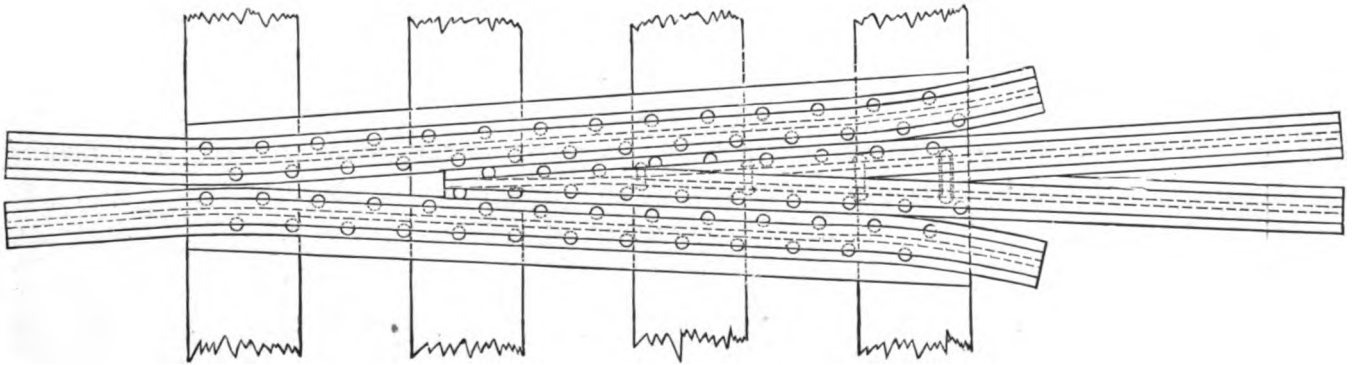
PATENTED.

PLATE FROG.

Fig. 8 is a plan of a Stiff Frog, riveted to a steel plate which is long enough to get a bearing on four ties. The plate is 5/8" thick and the rivets 3/4", passing through the base of the rail. The point rails are held together by rivets through the webs of the rails, and also to the base-plate. The whole plan makes an exceedingly elastic Frog.

PLATE FROG.

Fig. 8.



REMARK.

The illustrations in this catalogue are photographed down from carefully produced scale drawings, and all parts shown are in proportion to the material as actually furnished.

SPRING-RAIL FROG.

For the past twelve years we have been studying to improve the Spring Frog, and in that time we have made at least one dozen different improvements in their construction, and we submit to you herewith eight different designs to choose from.

All of our Spring Frogs are provided with steel base-plates to prevent the movable wing rail from cutting into the ties. This spring-wing rail is reenforced with a heavy bar 7/8" thick, of specially rolled iron, fitting exactly the shape of the rail, and bolted to the outside of the web of the rail. The bar, secured by this method to the rail, is of sufficient strength to insure holding the parts together in case of a fracture. We have also improved these Spring Frogs by increasing the length of the spring-wing rail towards the heel of the Frog, so as to insure the badly worn wheels traveling across the top of the point rails and the spring-wing rail on the same plane, and without opening the spring wing. When an additional protection is desired we plane the head of spring-wing rail where the double flange of a worn wheel-tread would be most apt to strike it. (See Figs. 10 and 11.) This unquestionably makes a much safer Frog, because it completely overcomes the danger there is of the movable wing rail being forced open by double flange when trailing the Frog.

SPRING-RAIL FROG.

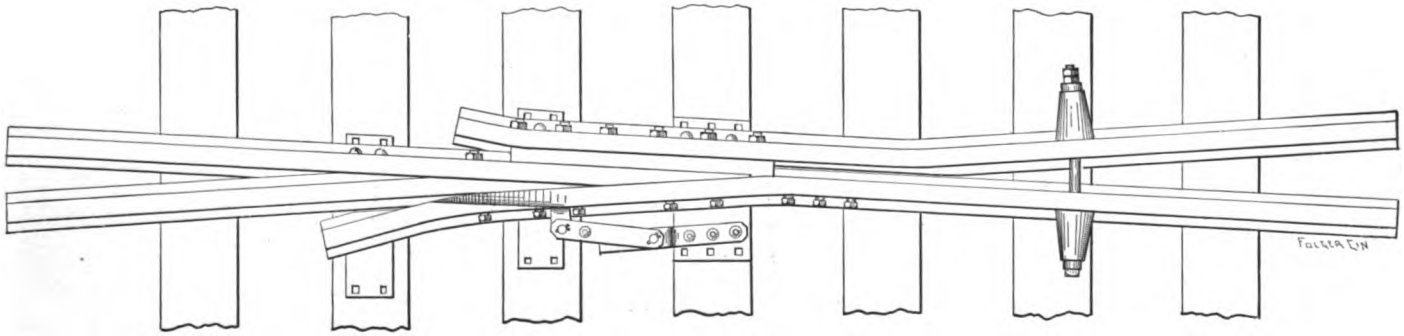
DESIGN NO. 2.

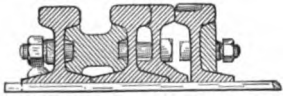
In this style of Frog we use a bent arm, one end riveted to the steel plate, and the other end acting as a holding-down device, in connection with the double links, which connect this arm to the movable wing rail. We know of no other device which resists the tendency of the spring wing rail to creep, and at the same time produces so little friction in the parts as this device does.

This is our Standard Spring-Rail Frog.

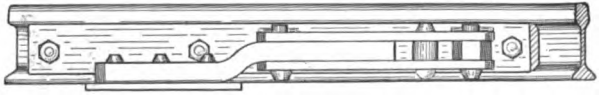
SPRING-RAIL FROG.

DESIGN NO. 2. FIG. 10.





SECTION THROUGH POINT.



SIDE VIEW OF HOLDING-DOWN DEVICE.

SPRING-RAIL FROG.

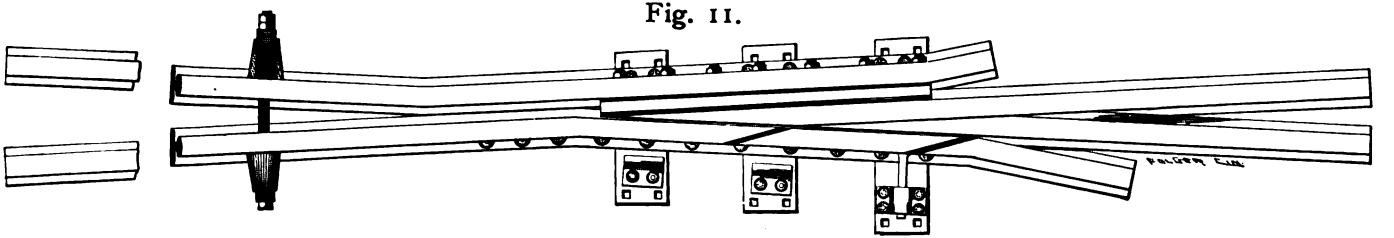
DESIGN NO. 3.

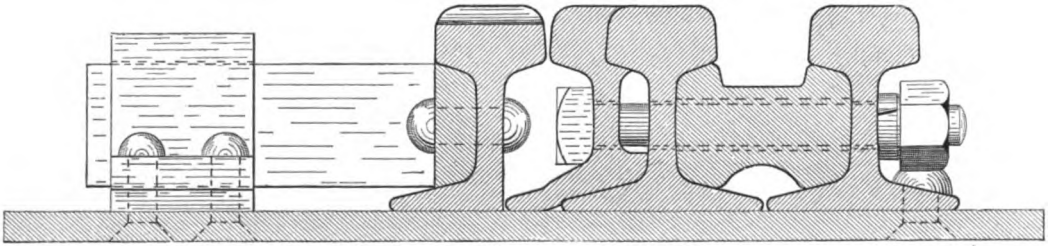
Here we have riveted to the plate a wrought-iron cuff in which slides an arm welded to the reenforcing bar, which is bolted to movable wing rail. On the other plate is a lip which prevents the wing rail from moving out too far. In addition to extending the wing rail far enough back of the point to prevent worn treads from opening it, we have planed through the top of the rail at the place where the double flange is apt to strike the head of the rail, and thus avoid the usual shock to the spring wing caused by the badly worn wheel tread.

SPRING-RAIL FROG.

DESIGN NO. 3.

Fig. 11.





SECTION SHOWING CUFF AND PLANING ON HEAD OF WING RAIL.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

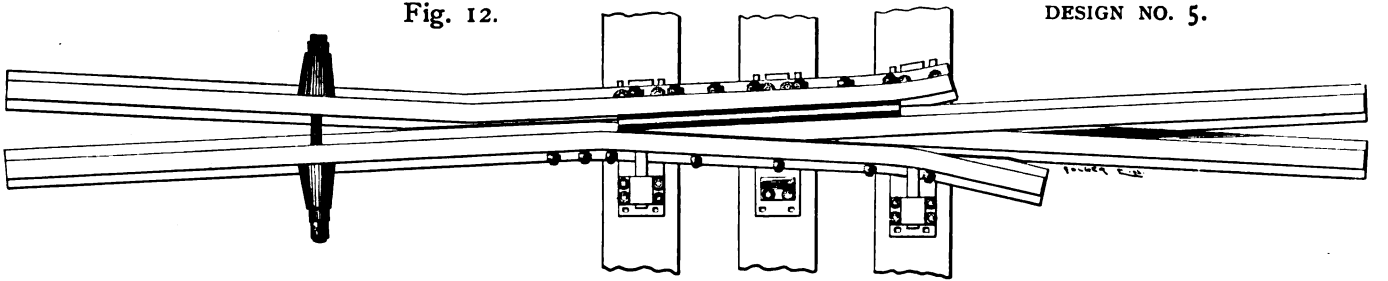
SPRING-RAIL FROG.

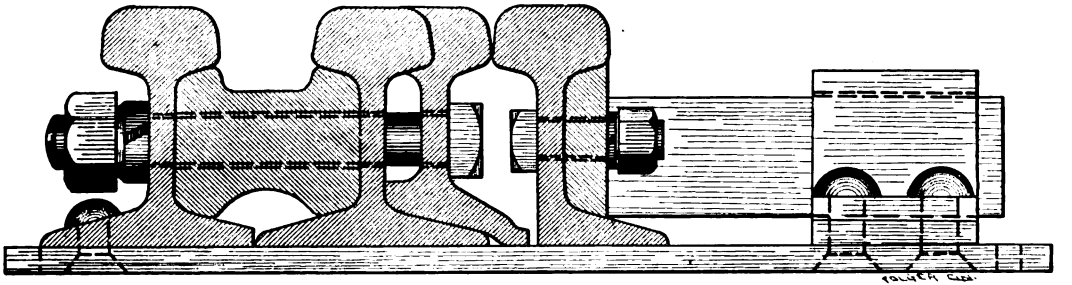
DESIGN NO. 5.

This is a modification of Design No. 3, in that it has two cuffs and arms in place of one, and the head of the movable wing rail is not planed, but the rail is extended far enough back of the point to prevent worn treads from opening it.

SPRING-RAIL FROG.

Fig. 12. DESIGN NO. 5.





SECTION SHOWING CUFF.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

SPRING-RAIL FROG.

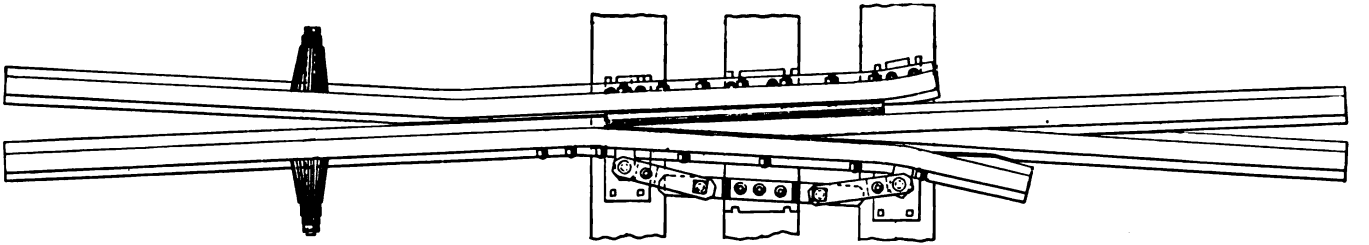
DESIGN NO. 6.

This is an improvement of Design No. 2, having two pairs of links in connection with a rigid arm which is bent at each end and riveted to the steel plate. In this we have an absolutely reliable spring-wing fastening, and we consider it one of the best designs we have, although somewhat more expensive than some others. This Frog is specially designed to be used in connection with Wharton Switches, which, by reason of the unbroken main track causes greater creeping of the rails, and consequently requires stronger resisting device for the spring wing.

SPRING-RAIL FROG.

DESIGN NO. 6.

Fig. 13.



ELEVATION OF HOLDING-DOWN DEVICE.

SPRING-RAIL FROG.

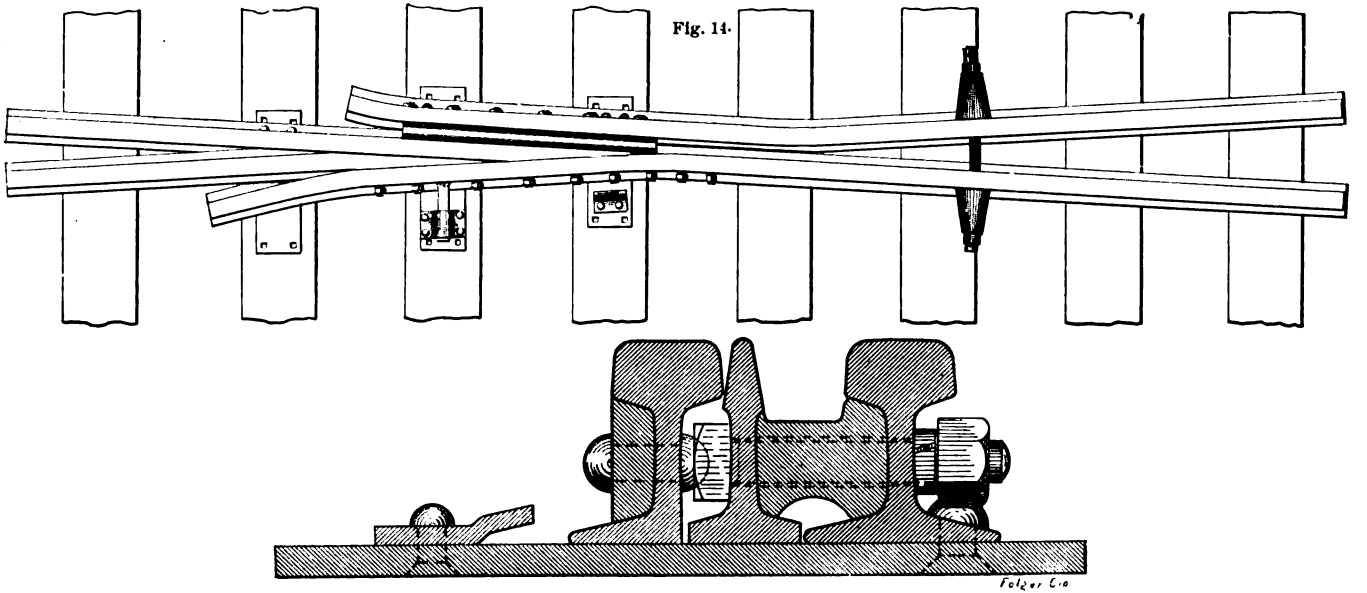
DESIGN NO. 7.

This Frog is the same as shown by Design No. 3, except greater distance between the steel supporting plates, and the planing through the head of the rail is omitted.

SPRING-RAIL FROG.

DESIGN NO. 7.

Fig. 14.



SECTION THROUGH PLATE AT POINT.

REMARK.

In case a railroad company has adopted a certain design of Spring Frog as a standard we shall be glad to have a blue-print or tracing sent to us from which to make an estimate on furnishing the Frogs in small or large quantities.

This is done, however, with the understanding that the railroad company will assume all responsibility in regard to infringement of any patent not owned and controlled by us.

SPRING-RAIL FROG.

DESIGN NO. 8.

We have made a number of these Frogs from plans sent us by a prominent Southern road, for use on their line. Besides having the two holding-down cuffs, the springs are placed back of the point, and two clamps, limiting the movement of the movable wing rail, are placed ahead of the point.

SPRING-RAIL FROG.

DESIGN NO. 8.

Fig. 15

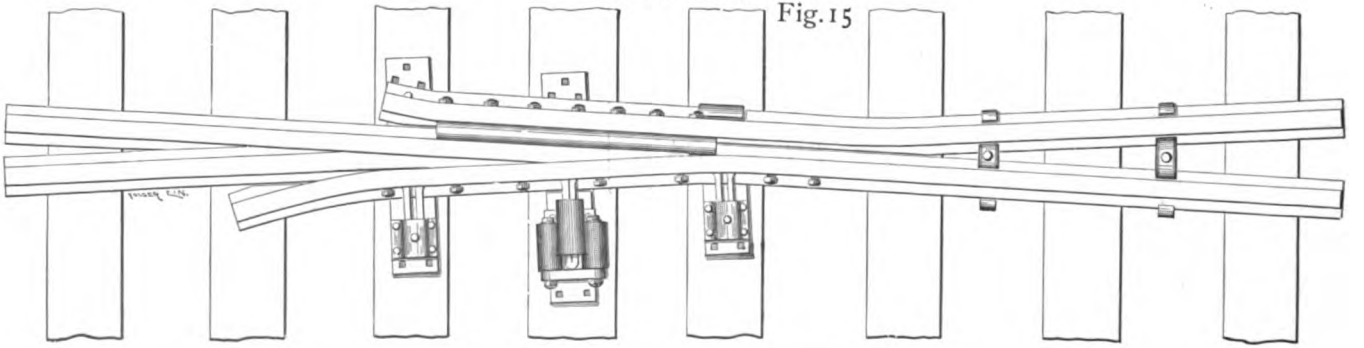
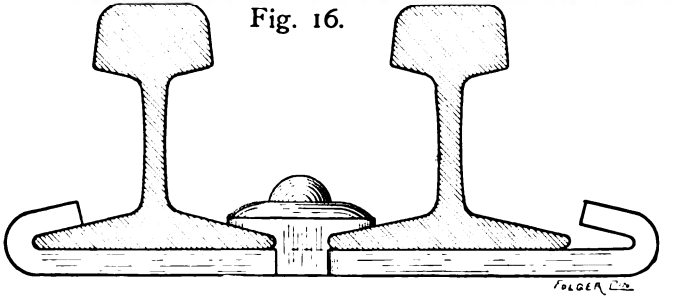


Fig. 16.



SPRING-RAIL FROG.

DESIGN NO. 8.

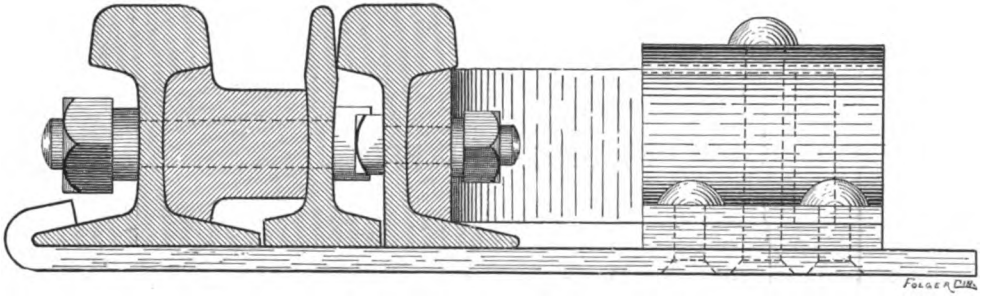


Fig. 17.

SECTION SHOWING CUFF.

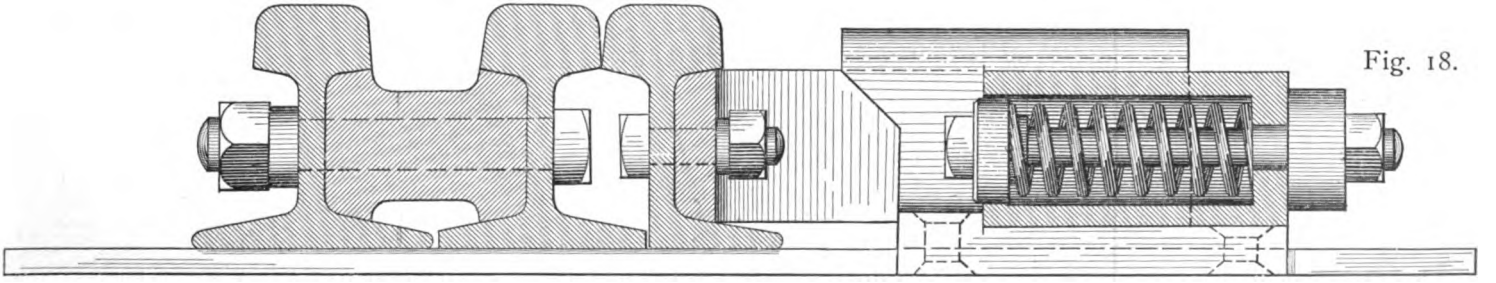


Fig. 18.

SECTION SHOWING SPRING HOUSING.

SPRING-RAIL FROG.

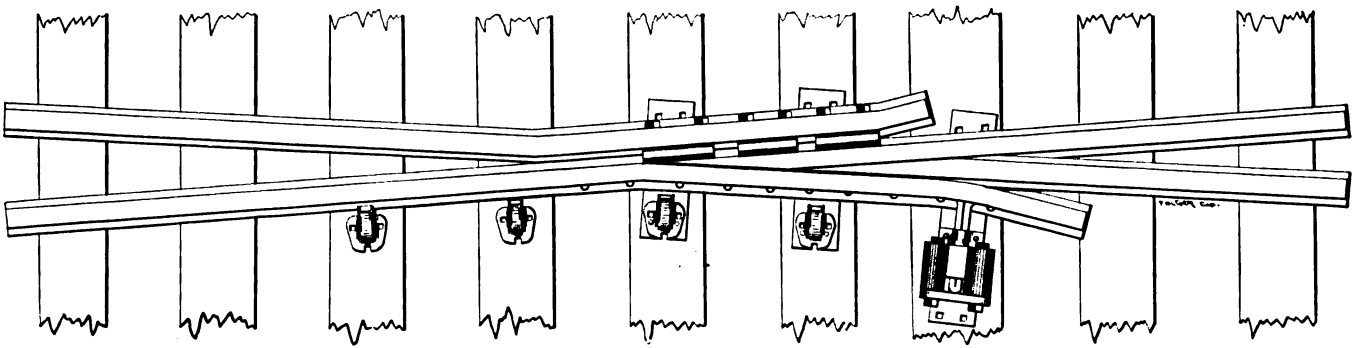
DESIGN NO. 9.

This is somewhat after the plan of Design No. 8, but differs in the fact that a wrought-iron holding-down cuff is placed directly in front of the spring casting and riveted to the same plate. On the other plates are riveted steel rail-braces to prevent the rail from rolling over, and to limit its motion. The filling blocks are cast iron, and the Frog is bolted with one-inch bolts.

SPRING-RAIL FROG.

DESIGN NO. 9.

Fig. 19.



NEW SPRING-RAIL FROG, WITH HINGED MOVABLE-WING RAIL.

There is probably nothing which has been such a source of annoyance and danger in the use of Spring-Rail Frogs as the creep of the main-track rails. This forces the loose Movable-Wing Rail out of its proper place, causing the holding-down arms to bind in their housings to such an extent that the Springs are not always powerful enough to overcome the unusual friction and bring the Movable Rail back tight against the point, after it has been opened by the train. If this should happen, the Frog is in an unsafe condition. Furthermore, the Movable-Wing Rail is necessarily the weakest of all parts of the Frog, and therefore most liable to fracture.

What is needed in a Spring-Rail Frog is: first, the Movable-Wing Rail entirely out of the main track so as not to be affected by creep of track; second, a Frog which is safe whether the Movable-Wing Rail is broken or whole; third, a Frog which will not allow the wheels to drop into the throat when the Movable-Wing Rail is not in place; and fourth, a Movable-Wing Rail which will not be forced open by trailing wheels having worn treads.

The Frog we illustrate by Figs. 106, 107, 108, and 109 fulfills these requirements:

First, the Movable-Wing Rail is hinged (Fig. 106) to a rigid rail, which is a part of the Frog, being

bolted to the filling and to the fixed wing, and also spiked to the ties. By this arrangement the creep of the track can not force the movable wing out of place.

Second, in case of misplacement and breakage of Movable-Wing Rail, a wheel will pass over this Frog without derailment, because it runs on a fixed rail until it meets the filling steel (shown in sections, Figs. 108 and 109), when it rides upon the flange over the break in the main-track rail.

Third, a wheel can not drop into the throat of this Frog for the reasons given above; it is continually on the rail or the filling.

Fourth, the planing of the head of the Movable-Wing Rail back of the point shown in plan, Fig. 106, and in elevation, Fig. 108, prevents the outside flange of a worn tread from opening the wing rail; in fact, the manner of planing is such that the wheel tends to crowd the wing rail closer to the point.

Besides the special advantages just enumerated this Frog has others worth mentioning. The filling runs up in the throat to the bend of the fixed wing; this makes the Frog exceptionally strong where it gets the greater shock. It is bolted together with eleven heavy bolts, and the movable wing is reenforced its entire length. It has four steel bearing-plates and two stops to limit the motion of the movable wing. The head of the wing near the hinge is planed down (Fig. 107) to prevent the shock due to worn treads striking it.

NEW SPRING-RAIL FROG, WITH HINGED MOVABLE-WING RAIL.

Fig. 106

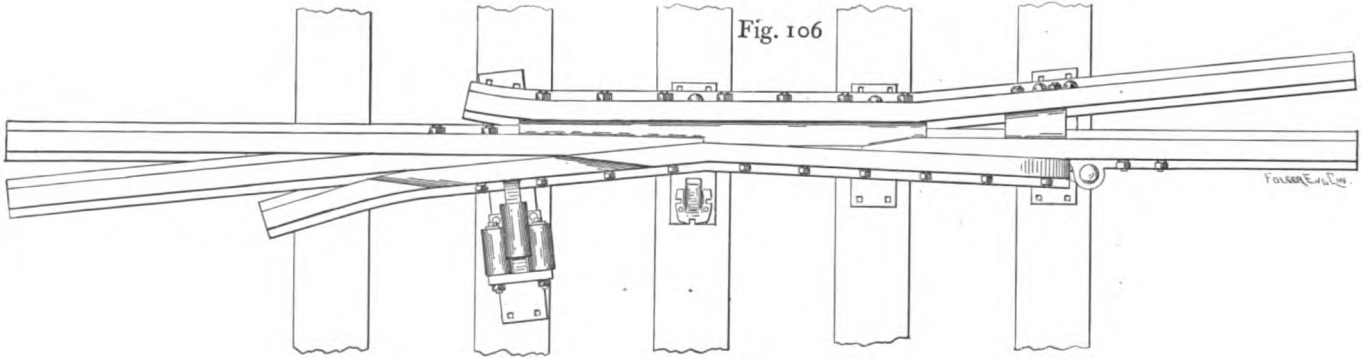
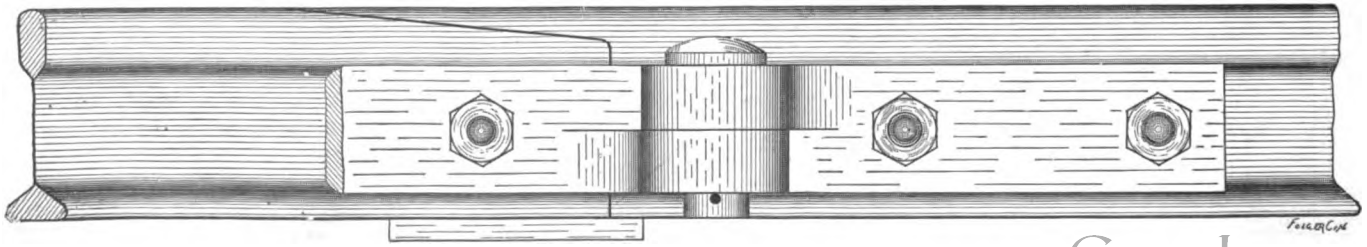


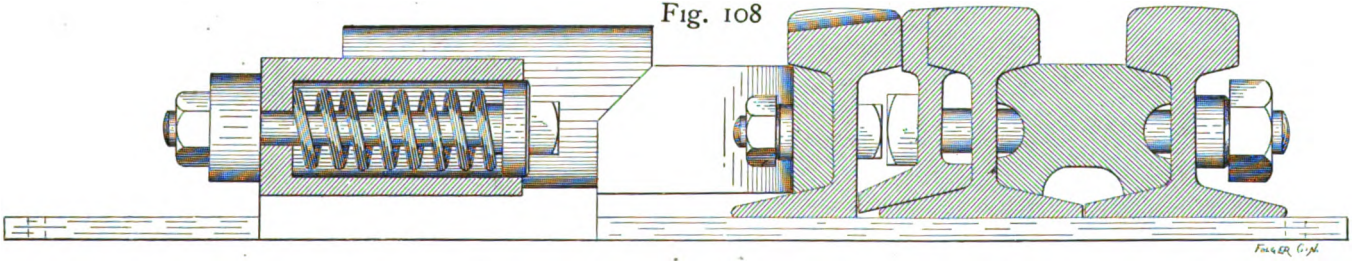
Fig. 107.



ELEVATION OF HINGE.

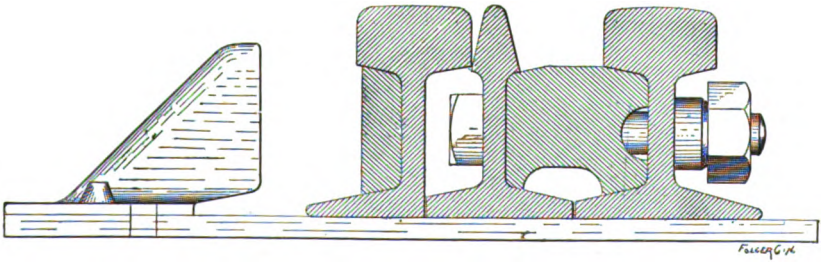
NEW SPRING-RAIL FROG, WITH HINGED MOVABLE-WING RAIL.

Fig. 108



SECTION THROUGH SPRING-HOUSING.

Fig. 109.



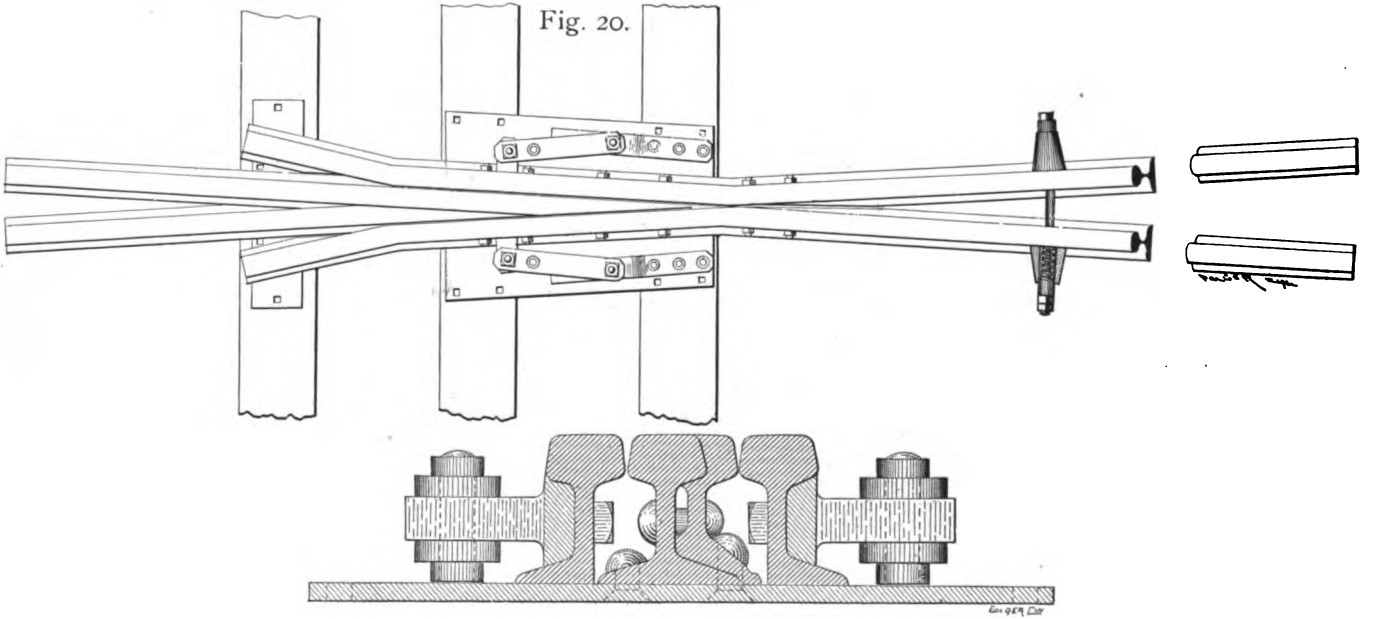
SECTION AT POINT.

DOUBLE SPRING-RAIL FROG.

We show by Fig. 20, in plan and cross section, a Frog with a Movable-Wing Rail on each side, for use at junctions, or where a double track runs into a single-track road. The point rails are riveted to the plates, to which the wing rails are attached by means of suitable devices. We have shown that of Spring-Rail Frog, Design No. 2. Any other one preferred can be used.

DOUBLE SPRING-RAIL FROG.

Fig. 20.



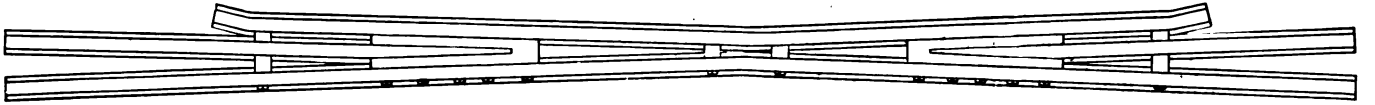
FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

DOUBLE-POINTED OR CROSSING FROG.

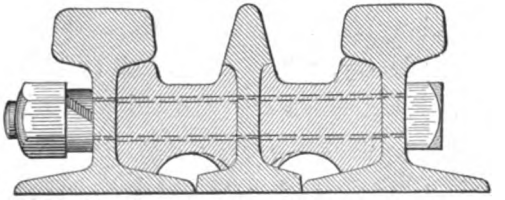
One of these Frogs, as well as the regular single-pointed Frogs, is required for every turnout on double-gauge roads using a third rail, and we have furnished hundreds of them for all the important lines using the Standard 4′ 8½″ and 3′ 0″ Gauges. The construction is the same as that of single-pointed Frogs, and shown by cross section.

DOUBLE-POINTED OR CROSSING FROG.

Fig. 21.



SECTION OF RAILS AT END OF POINT RAIL.



CROSSINGS.

In the past ten years we have gotten up five or six different designs of Crossings. Among these was one in which we used reenforcing and elevating rails on the outside of the main-track rail, and after some years' experience with work made in this way have abandoned them, and finally settled on the plans shown by Figs. 22, 23, 24, and 25 as being the best designs we can suggest. The filling material for these Crossings can be furnished of solid specially formed steel of three different shapes (see page 51), and we are using special straps, or as they are very heavy, might be called bars, for the outside and inside corners of these Crossings. In the making of these Crossings every wearing portion is cut to exact length with a cold saw, so that the temper of the steel is not changed from one end of the rail to the other. The construction is such that the running rails have the full web support to the extreme end of the same. Attention is specially called to the bolting by the use of from 72 to 80 7/8" bolts, made of the best of iron, the widest National Nut Lock made especially for us, and Hex Nuts. Right here we would like to call attention to

the factor of safety which the unusual number of bolts gives, for forty-five percent of the bolts in our Crossing might break, and still we would have as much strength as some manufacturers have in their Crossings when new. These, combined with the open-hearth steel plates used under each corner or intersection, make a specially strong and durable structure. We are prepared to furnish these Crossings in any number, any angle, or any curve, and guarantee the angle and curves perfect in every respect; also guarantee prompt delivery at prices as favorable as any other manufacturer.

When comparing our prices with those of other manufacturers, please do not lose sight of the fact that our Crossings have more Bolts, and the long fillings and strap-irons fit the rails more accurately than any other design in the market.

RAILROAD CROSSING, 90 DEGREES.

SOLID PATTERN.

Fig. 22 is a plan with cross sections of our Railroad Crossing, and shows the design of all angles for 48 to 90 degrees. The section illustrates the different styles of filling steel, which we letter sections A, B, and C, so that customers may be able to designate which section is desired.

For description see pages 48 and 49.

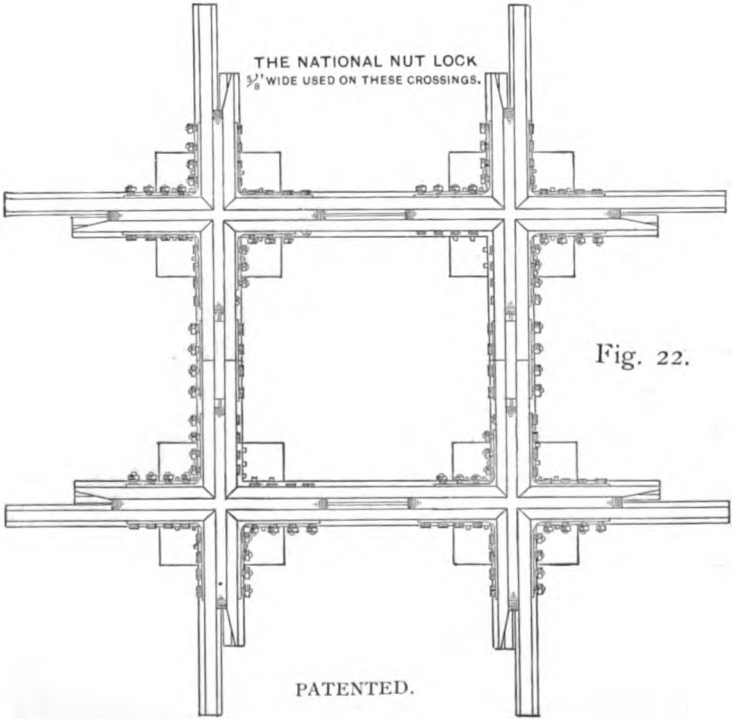
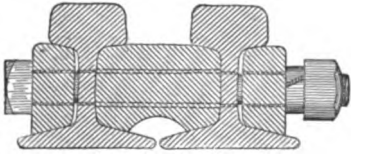


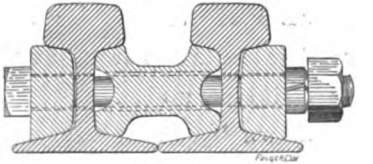
Fig. 22.

RAILROAD CROSSING, 90 DEGREES.

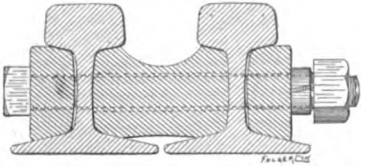
SOLID PATTERN.



Section A



Section B



Section C

RAILROAD CROSSING, 45 DEGREES.

SOLID PATTERN.

This is made the same as the 90-degree Crossing, with two exceptions. First: that the joints are not all beveled, but instead of that, the head of one rail runs through to the filling, and the other butts against it; and secondly: that the strap irons at the acute corners are bent in such a way as to form a stiffer brace at the joints than could be gotten if the straps were bent, as shown in the 90-degree Crossing. Either style of filling steel, as shown by Figure 22, can be used

RAILROAD CROSSING, 45 DEGREES.

SOLID PATTERN.

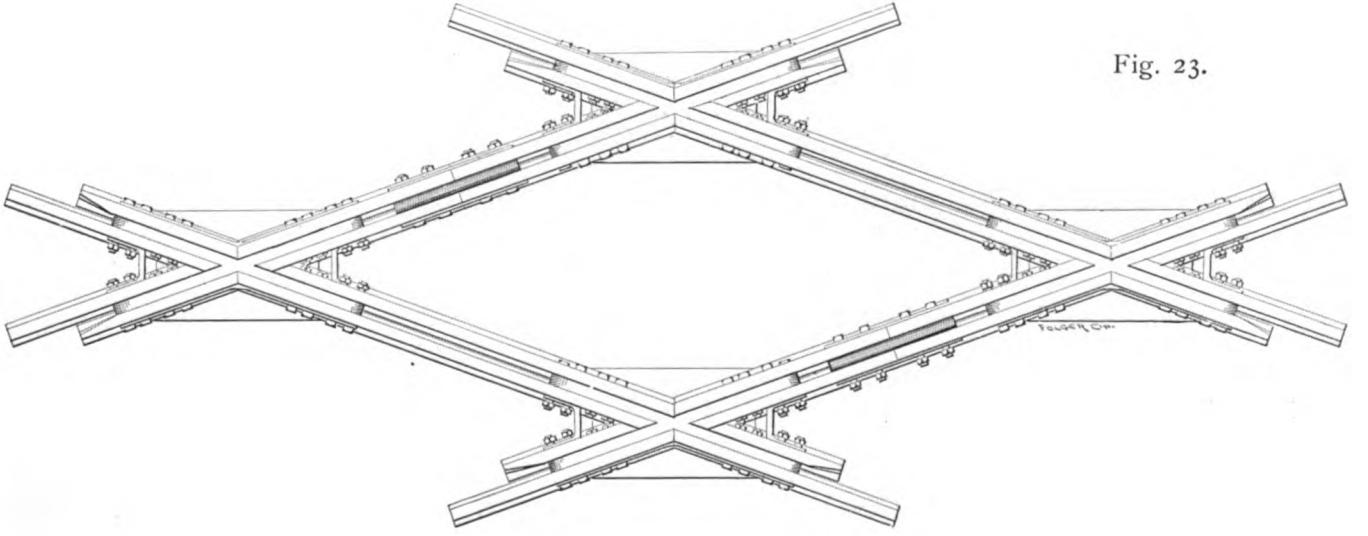


Fig. 23.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

RAILROAD CROSSING, 30 DEGREES.

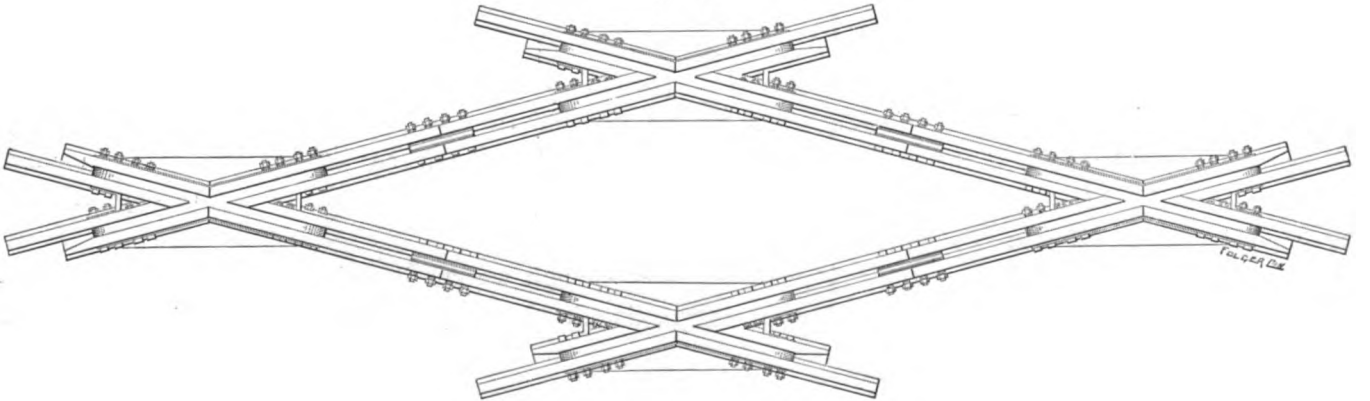
SOLID PATTERN.

The construction of this is the same as the 45-degree Crossing, except that it is cut in four sections for convenience in shipping. This is the highest-price Crossing we make which has inside guard-rails, because of the amount of material and extra labor required. A lower-priced Crossing of this angle can be made as shown by Fig. 25, but we do not recommend this cheaper Crossing for any angle above 25 degrees.

RAILROAD CROSSING, 30 DEGREES.

SOLID PATTERN.

Fig. 24.



RAILROAD CROSSING.

FROG PATTERN.

All Crossings from 8 to 25 degrees are made after this style, and Crossings from 25 to 30 degrees may be made in this way, or on a better, but high-priced plan, shown by Fig. 24, as preferred.

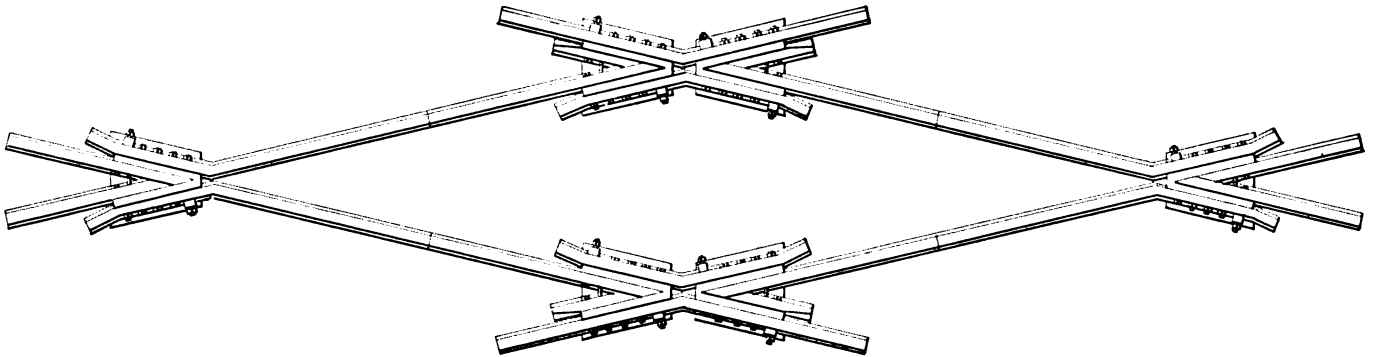
We use either design of filling steel shown on page 43, and 7/8" bolts, 5/8" National Nut Locks, and furnish 1/2" steel plates to be placed under each point. To hold the frog-points securely in place we use a brace made of 7/8" iron, fitting the shape of the rail, and rigidly held by means of the bolts. We guarantee the workmanship good, and the angles and curves accurate. To reduce the cost of these Crossings the steel plate may be omitted, but we do not recommend it.

When the distance between the frog-points is great enough we cut in filling rails between the Frogs, because the latter are not so apt to be knocked out of line in shipping, and the Crossing can be placed in the track and lined up more easily.

RAILROAD CROSSING.

FROG PATTERN.

Fig. 25.



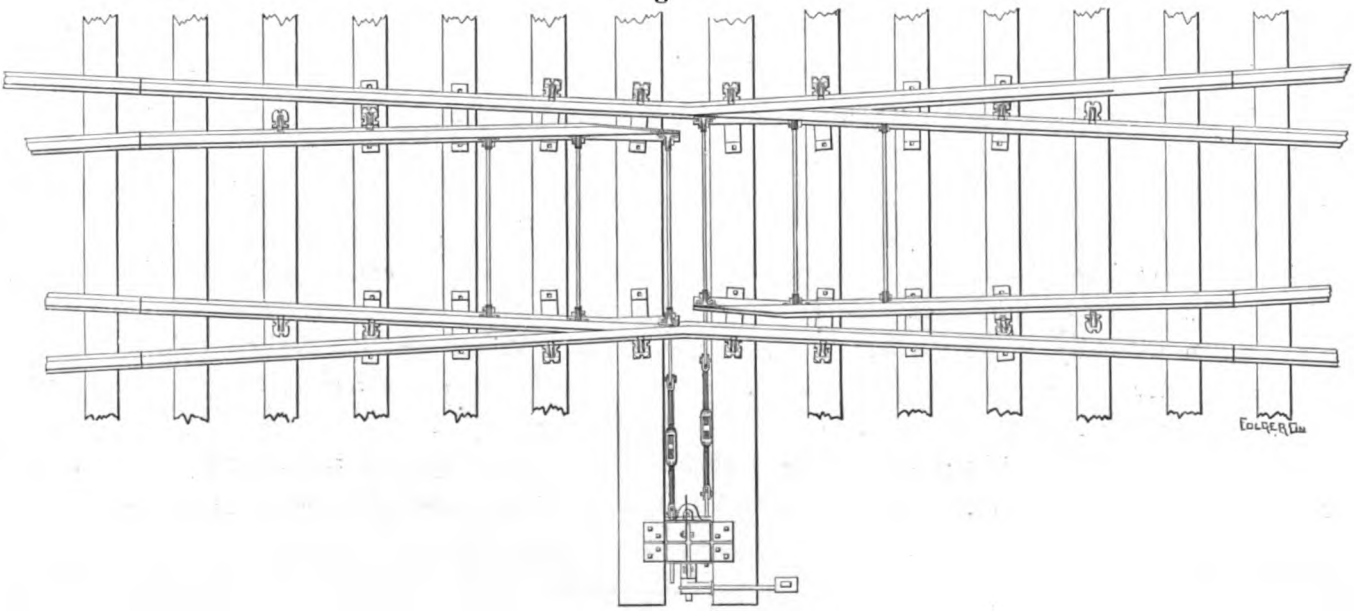
MOVABLE POINT-RAIL CROSSING.

When the crossing angle is below 8 degrees, or if either or both of the tracks are on a curve, we advise the use of a device shown by Fig. 26, in place of the rigid double-pointed middle sections of a Frog crossing. Inasmuch as there is quite a distance between the points of a rigid double-pointed Frog which can not be guarded, the danger of derailment becomes very great, and to avoid this we have designed the two movable point rails connected to and operated by one single lever ground stand.

The details are the same as on our Standard No. 1, Split Switch, Figs. 32, 33 and 34.

MOVABLE POINT-RAIL CROSSING.

Fig. 26.



COMBINATION CROSSING, OR DOUBLE SLIP SWITCH.

DESIGN NO. 2.

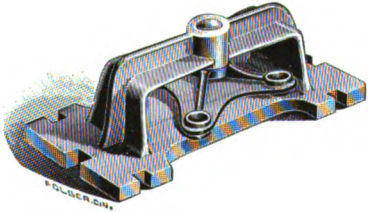
We show by Fig. 29 our Standard Combination Crossing. The construction of the Frogs of the Crossing is the same as our Standard Stiff Frog (Fig. 5), and the point rails are the same as our Standard No. 1 Split Switch (Figs. 32, 33, and 34). The throwing device is on the outside of the Crossing, and all the points are operated by one Low-Target Ground-Throw Stand (Fig. 96). The T cranks and bases (Fig. 110) have been improved, giving a top and bottom bearing to the crank-pin This arrangement reduces the lost motion at this point to a minimum.

The Turn-Buckles in the rods afford a means of adjustment between the Switch Points and Stand. This throwing device is positive in its action, and moves the point rails with remarkable ease, thus ensuring quick work on the part of the switchmen.

We can guarantee this Crossing to be first-class in every respect, and recommend its use in freight and passenger tracks as an expedient to save yard-room, and the time and labor of the yardmen.

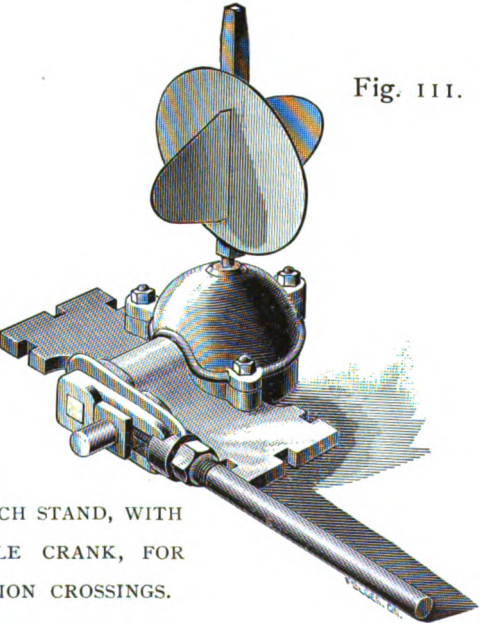
FIXTURES FOR COMBINATION CROSSINGS, OR DOUBLE SLIP SWITCHES.

Fig. 110.



NEW T-CRANK AND BASE FOR COMBINATION CROSSING THROWING-DEVICE.

Fig. 111.

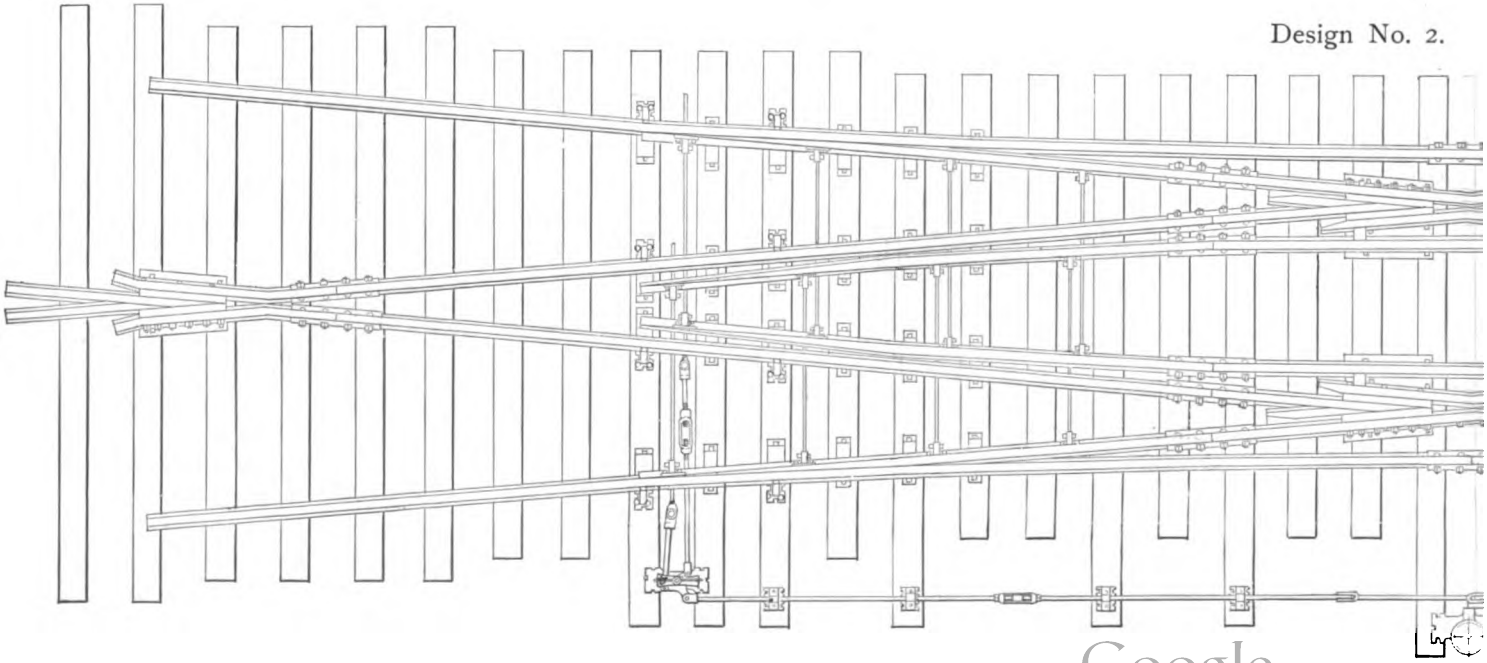


NEW SWITCH STAND, WITH ADJUSTABLE CRANK, FOR COMBINATION CROSSINGS.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

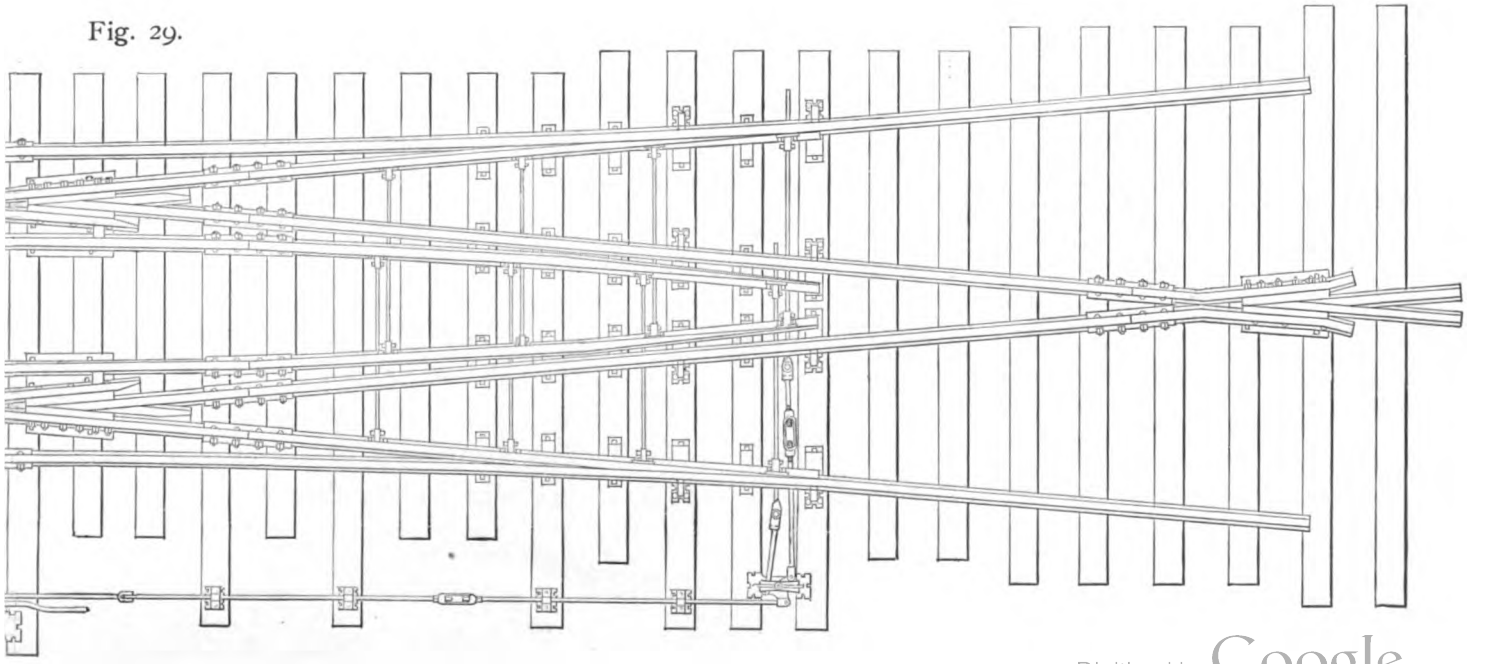
COMBINATION CROSSING, WITH

Design No. 2.



OUTSIDE THROWING-DEVICE.

Fig. 29.



COMBINATION CROSSING,
WITH MOVABLE FROG POINTS AND OUTSIDE THROWING-DEVICE.

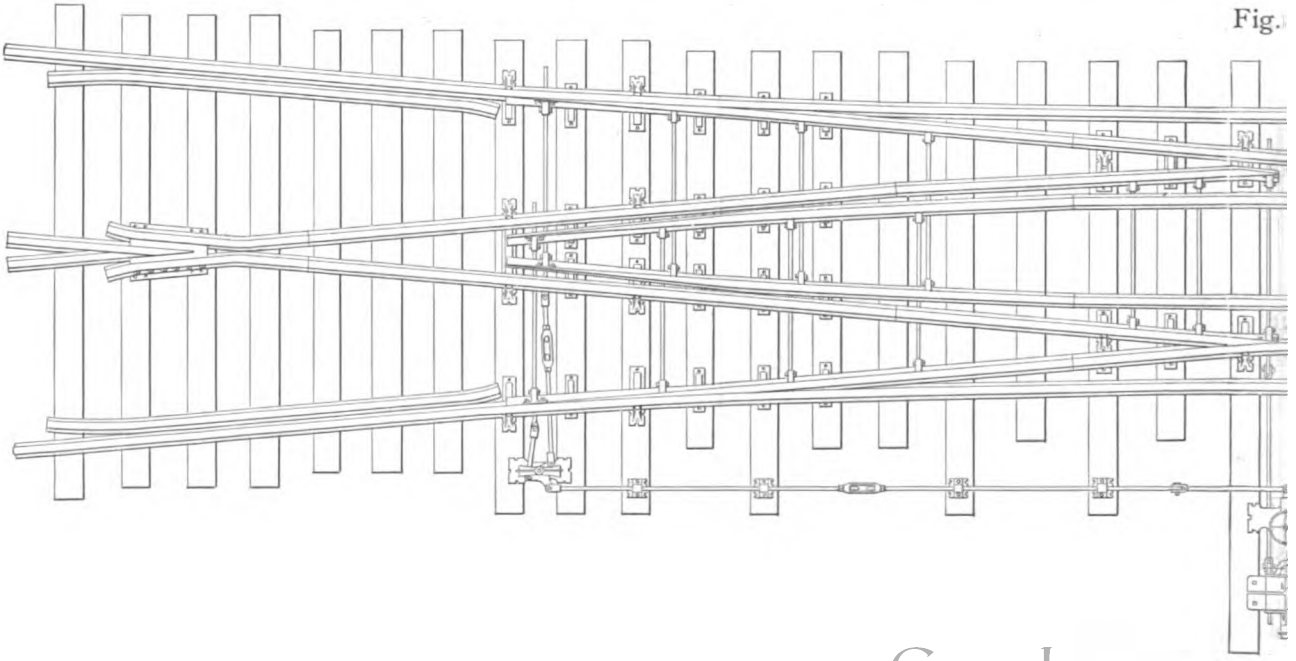
When either one or both tracks are on a curve, or when the angle of the Crossing is less than 7° 10′, it should be made with movable Frog Points (Fig. 26) in place of the rigid double-point middle sections. This makes a Crossing with six pairs of Switch Points, which can be operated by two independent Stands placed one back of the other, as shown by Fig. 112, or side by side, whichever is preferred.

The bell-crank housings at the end of the throw-rod have a top and bottom bearing for the pins, and rest upon two ties, which we consider a great improvement, and have adopted them for all our Combination Crossings.

We can throw these Switches by means of our patented single-lever Stand, thus doing away with the confusion due to two Stands. This we can furnish when desired. The arrangement of this Stand is such that there is no strain upon the handle to hold the point rails, no matter what position they occupy.

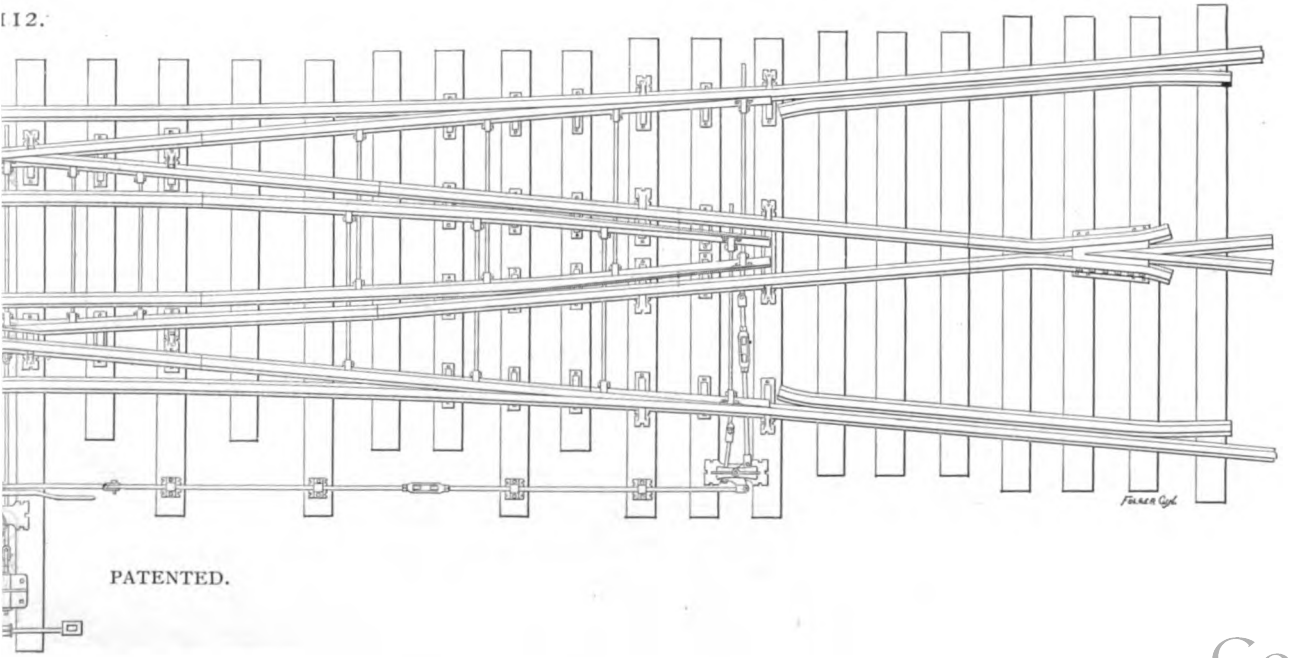
COMBINATION CROSSING OR SLIP SWITCH, WITH MOV

Fig.



ABLE FROG-POINTS AND OUTSIDE THROWING-DEVICE.

[12.



PATENTED.

COMBINATION CROSSING,
WITH REENFORCED SWITCH-RAILS AND ADJUSTABLE SWITCH-RODS.

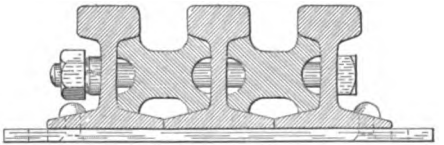
DESIGN NO. 4.

Combination Crossings are the most useful of all track appliances in crowded yards, but at the same time they have always been more or less troublesome to maintain. This is partially due to the wear of the parts which in time results in considerable lost motion, so that the Switch Points do not close tight against the stock-rail.

The Crossing shown by Fig. 89 provides means of taking up all this lost motion by means of the adjustable rods on the Switches (Fig. 113) and the turn-buckles in the throw-rods. To make it complete, the Switches should be thrown by the adjustable crank Ground-Throw, shown by Fig. 111, page 61 By the use of this device the Switches will always have enough throw to prevent the wheels from striking the open point. Furthermore, in this Crossing the gauge of the turnout tracks is wider on account of the curve. This is accomplished by moving the outside points one tie ahead of those in the center of the Crossing. In other particulars the Crossing is the same as Design No. 2, Fig. 29, page 62. We consider this Design (No. 4) the *ne plus ultra* of combination crossings, being one on which no repairs due to wear will be necessary until it is completely worn out.

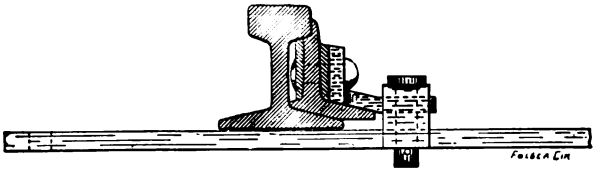
COMBINATION CROSSING
WITH REENFORCED SWITCH-RAILS AND ADJUSTABLE SWITCH-RODS.

Fig. 86.



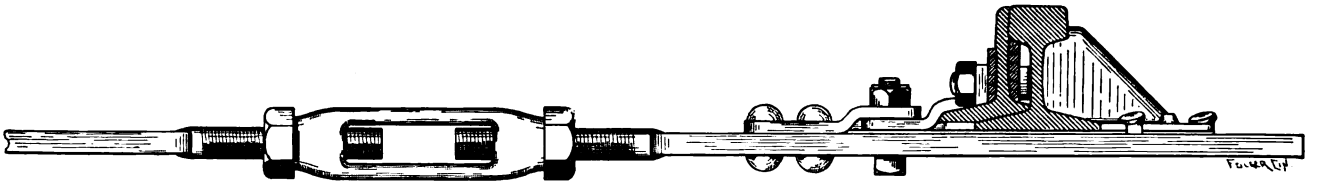
SECTION OF FROGS.

Fig. 87.



SIDE VIEW OF INSIDE FASTENING FOR SWITCH-RODS.

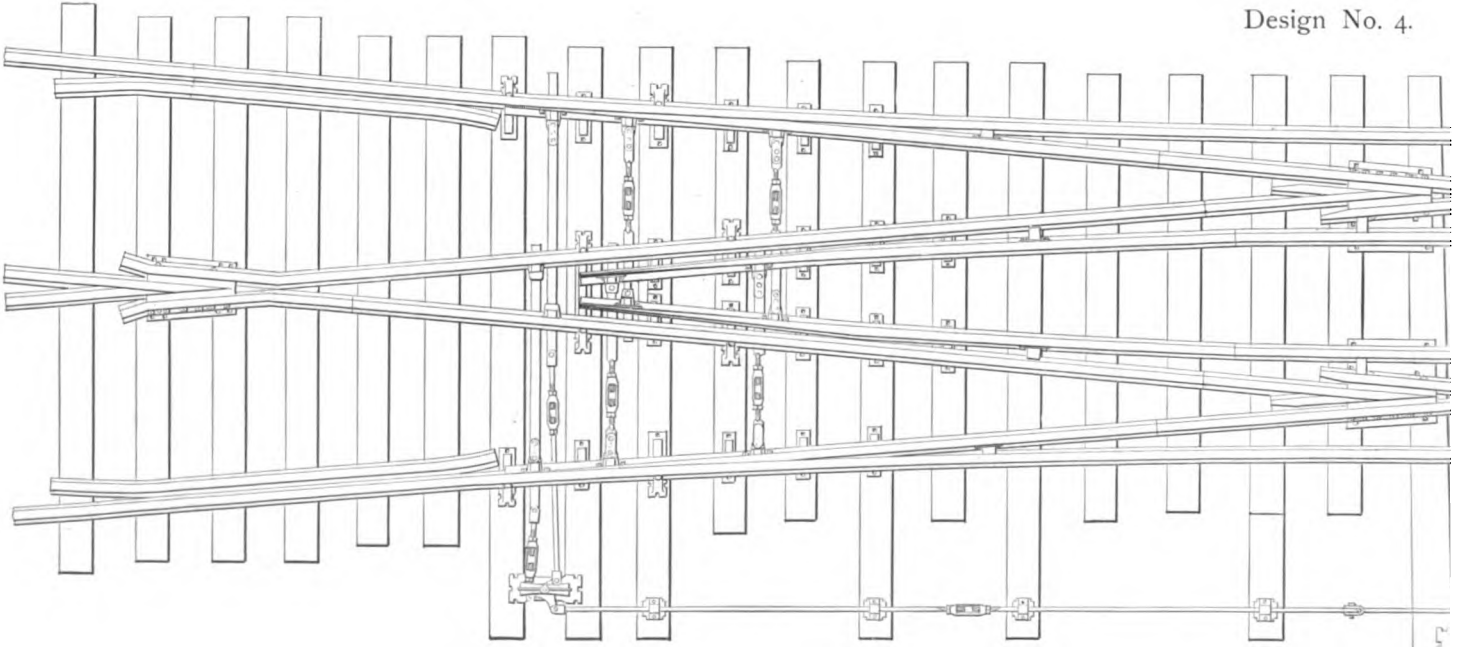
Fig. 113.



SECTION SHOWING OUTSIDE FASTENING AND ADJUSTABLE SWITCH-ROD.

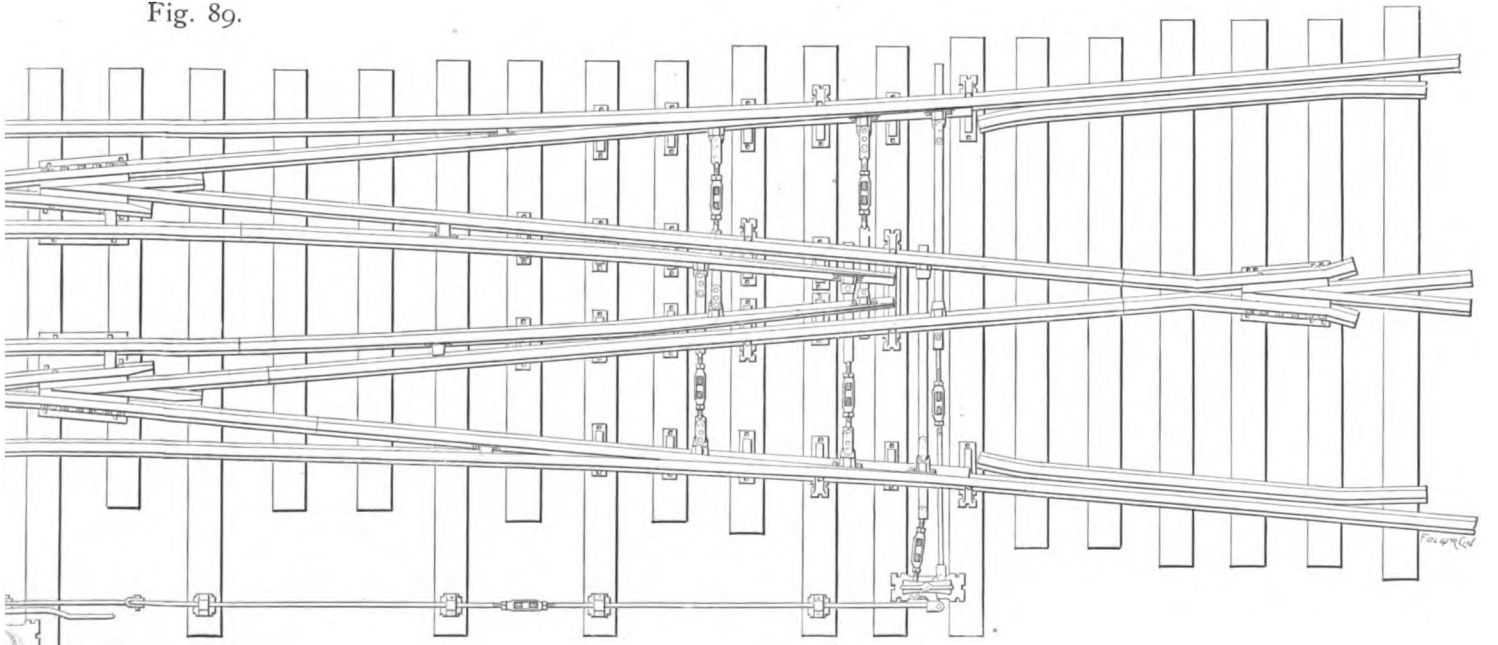
COMBINATION CROSSING, WITH REENFORCED

Design No. 4.



SWITCH-RAILS AND ADJUSTABLE SWITCH-RODS.

Fig. 89.



PATENTED.

CROSSING FOR STREET ROADS OVER STEAM-ROAD TRACKS.

DESIGN NO. I. ANGLE 90 DEGREES.

We show in plan and section what we call our Electric-Road Crossing, which fulfills all the requirements of the steam railroad, and also the electric road.

We plane a flangeway through the heads of the steam-road rails. It is 7/8" deep and 1" wide. We do this because it will wear through if it is not planed, and we think it better to cut it through and then reenforce the weakened portion by heavy filling and strap-irons. Two inside guard rails are placed on the steam-road tracks, and at each crossing corner is placed a piece of our filling steel, upon which the steam-road equipment is carried over without shock. We use heavy stray-irons at the corners and bolt the work together with forty 3/4" and 7/8" bolts and nut-locks, and we furnish steel plates under each intersection when desired.

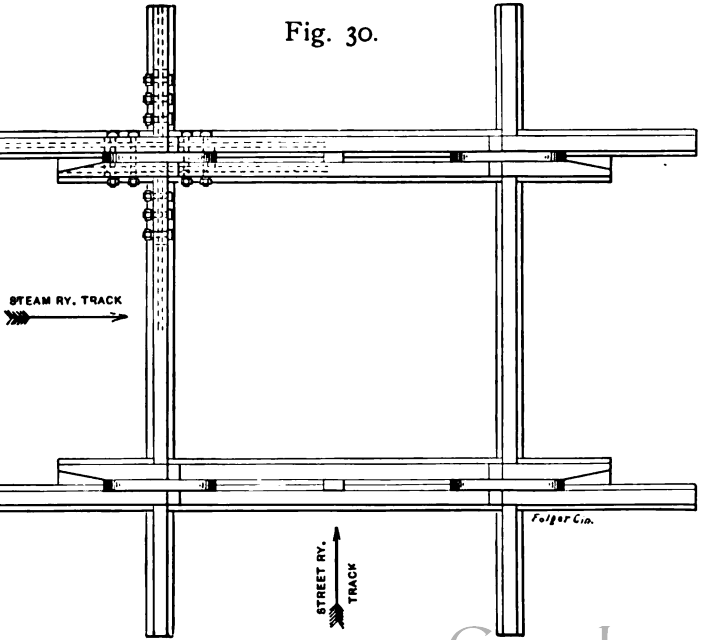
We make these Crossings any angle and curve, and use any section of street girder-rail on the street-road track, but we prefer to make them completely of T rail, because it permits of a more substantial construction. To protect the planking near the street rail we can bolt an angle iron on the gauge side of this rail, if so desired. This makes the T rail practically a girder-rail, and still retains the advantages of the T rail. See Fig. 114,

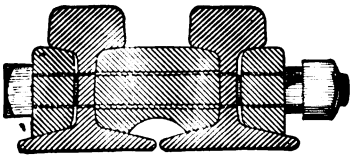
CROSSING FOR STREET ROADS OVER STEAM-ROAD TRACKS.

ANGLE 90°

Fig. 30.

DESIGN NO. 1.





SECTION THROUGH STEAM-ROAD TRACK

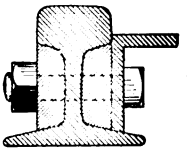


Fig. 114.

SECTION THROUGH STREET-ROAD TRACK SHOWING ANGLE IRON.

CROSSING FOR STREET ROADS OVER STEAM-ROAD TRACKS.

DESIGN NO. I. ANGLE 45 DEG.

We illustrate here a Crossing of the same general design as Fig. 30, but a more acute angle. The only difference is in the corner strap irons, which are bent to form a stiffer brace than the same method used in a 90° Crossing would allow.

We can add, when desired, the angle iron to the street rail, as shown in cut on page 73, and furnish steel plates under each corner.

CROSSING FOR STREET-ROADS OVER STEAM-ROAD TRACKS.

ANGLE 45° DESIGN NO. I.

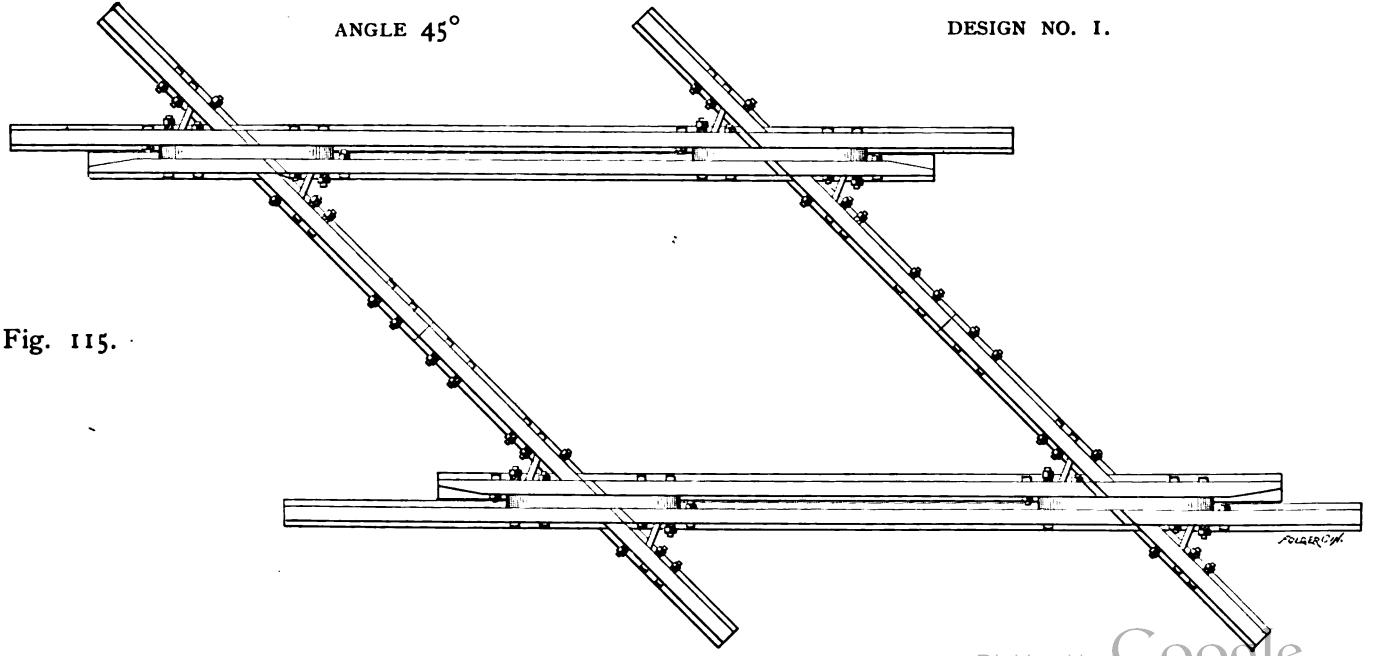


Fig. 115.

CROSSING FOR STREET ROADS OVER STEAM-ROAD TRACKS.

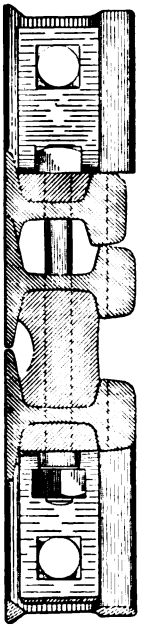
DESIGN NO. 2. ANGLE 90 DEG.

This Crossing has all the advantages of the style shown by Fig. 30, page 73, and the additional feature of reenforcing rails on the outside of the steam-road rails. The street-road rails are secured to these reenforcing rails, which are of a section of less height than the steam-road rail. By this arrangement we avoid the shock due to the worn wheel-treads of passing cars and locomotives striking the head of the street-road rails. This, of course, prolongs the life of the crossing, because the strap-irons and bolts are less liable to break.

We can furnish these with steel plates under each intersection and with angle iron bolted to the gauge side of the street-road rail, if it is desired and so specified in the order.

CROSSING FOR STREET ROADS OVER STEAM-ROAD TRACKS.

DESIGN NO. 2. ANGLE 90°.



SECTION THROUGH STEAM-ROAD TRACK.

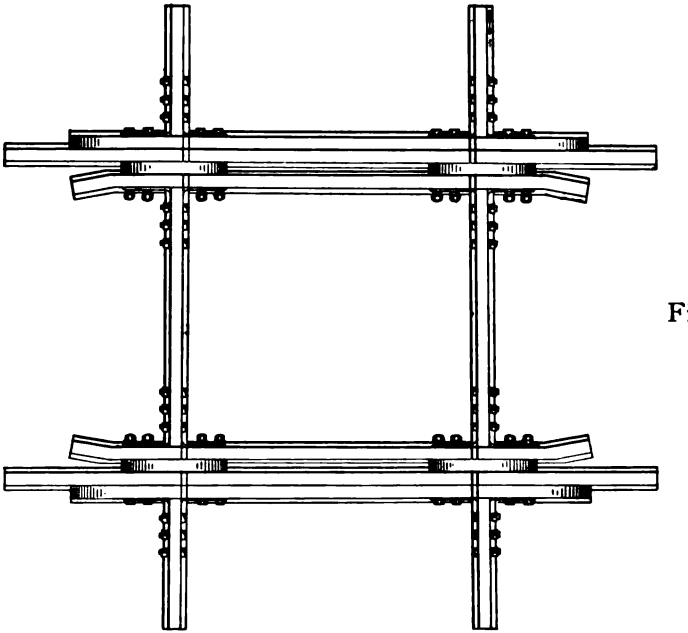


Fig. 116.

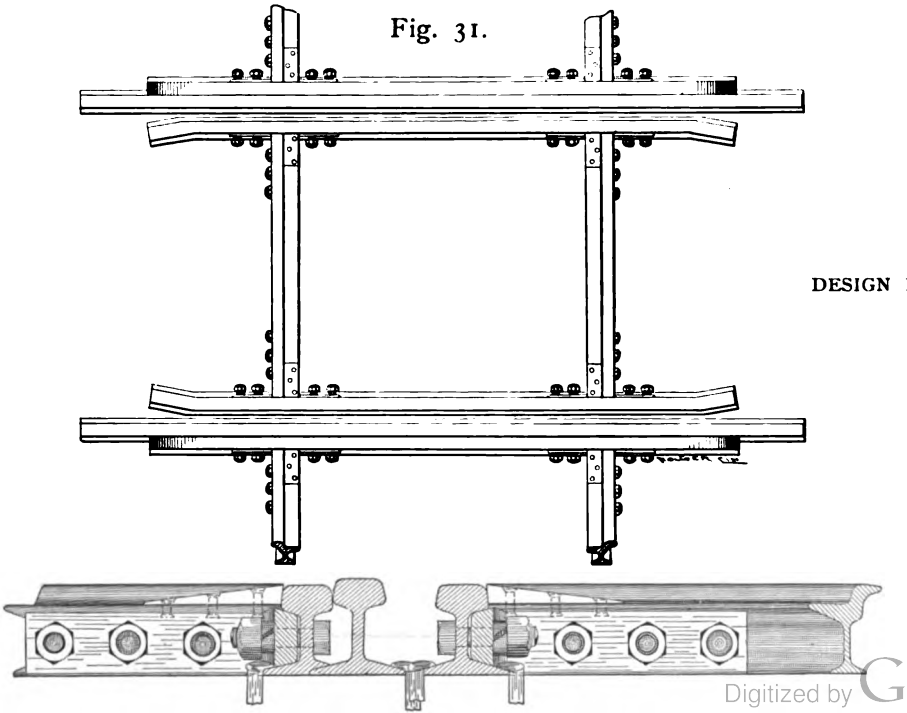
THE CROWELL-WEIR PATENTED STREET AND RAILROAD CROSSING.

DESIGN NO. I.

We are the first to produce a substantial street-road crossing which could be put in without disturbing the steam-road rails. It is made in three sections. The middle section includes the crossing rails of the street-road track, bolted to the inside guards of the steam-road track, and the two outside sections include the end rails of the street-road track bolted to the outside guard-rails. No flangeway is cut through the steam-road track, but by means of a rising plate the flange of the car-wheel is lifted on top of the head of the steam-road rails, and passes over them. *Our patent covers this rising plate, and also a crossing made in three ndependent sections to accomplish the purposes described*

THE CROWELL-WEIR PATENTED STREET AND RAILROAD CROSSING.

Fig. 31.



DESIGN NO. I.

THE CROWELL-WEIR PATENTED STREET AND RAILROAD CROSSING.

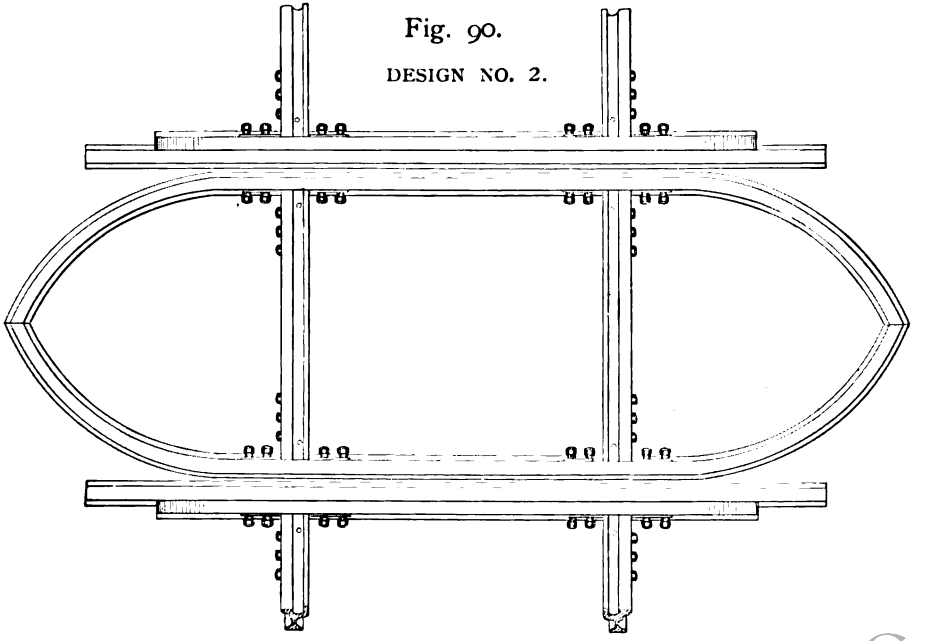
DESIGN NO. 2.

By Fig. 90 we show a plan of a modified Crowell-Weir Crossing. This Crossing is the same as our regular Crowell-Weir Pattern (Fig. 31), and has all the advantages of the latter except that the guard-rails of the railroad track are curved to meet in the center as shown. We illustrate it to show those who desire this feature that we are prepared to meet their wants. It will be noticed that the plan shows solid guard-rails on the street-road track, which are used when desired.

THE CROWELL-WEIR PATENTED STREET AND RAILROAD CROSSING.

Fig. 90.

DESIGN NO. 2.



STANDARD NO. 1 SPLIT SWITCH.

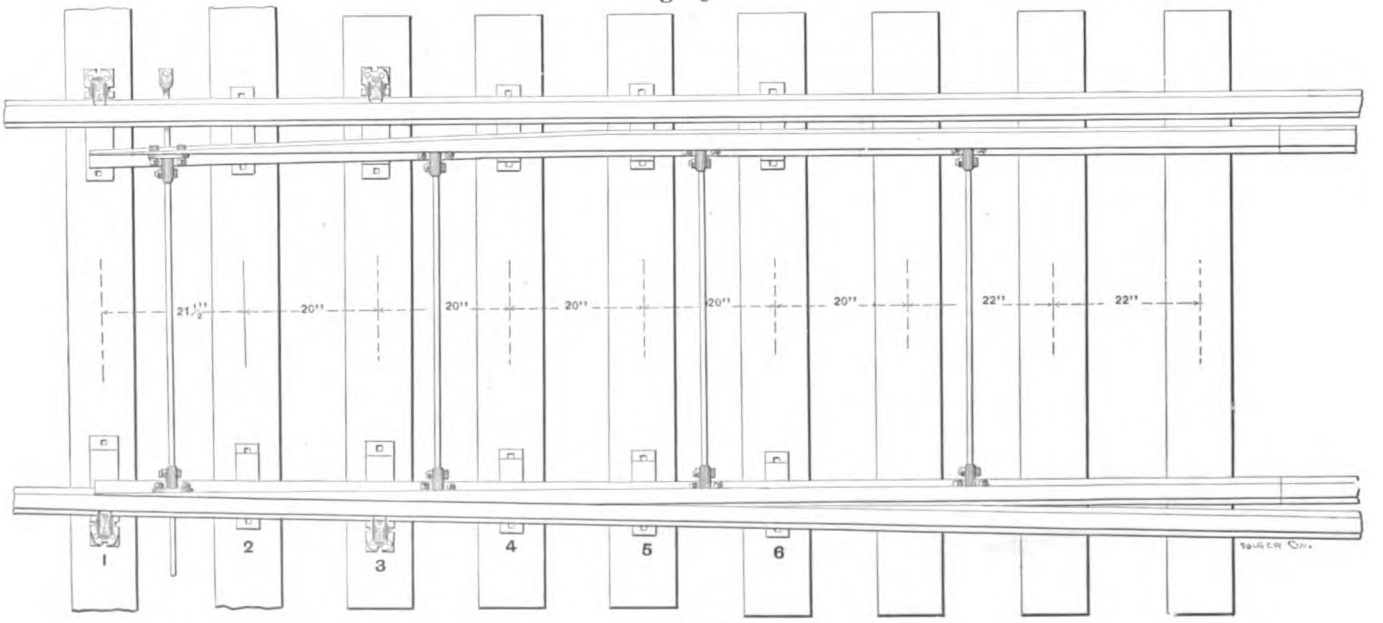
(ANGLE 1° 40′ 16″, 5¼″ SPREAD, 15 FEET LONG, ¼″ POINT.)

Our No. 1 Split Switch, shown in plan and cross sections in Figs. 32, 33, and 34, pages 84 and 85, combines all there is of any value in the well-known Clarke-Jeffrey Switch, with our latest patented improvements. In the construction of this Switch we use steel die-formed braces, all-steel friction-plates extending through under both point and main-track rails, always insuring an equal bearing on the friction-plates and top of base of stock-rail, which is not the case with those having short friction-plates passing only under the point-rail and butting up against the stock-rail. We desire to call attention to our steel die-formed tie-bar fastenings, and die-formed brace riveted to the steel friction-plates. These die-formed fastenings are made to permit of the use of the bars edgewise, which enables us to use the connecting bolts horizontally instead of vertically, thereby gaining a rigidity in the construction of the Switch that is necessary to prevent rolling or twisting of the rail, as does occur with the flat bar. This specially die-formed fastening is so made that when

the tie-bars are in and bolted up, there is sufficient end movement with one rail ahead of the other to prevent cramping of the rails, and give all the necessary motion that is obtained by the jointed bar, and at the same time permits of the bars being drawn together by the bolts sufficiently tight to prevent any rattling. We can make these Switches of any desired length. We wish to call attention to the fact that our friction-plates are all numbered with steel figures, and that the plates must be put in the track according to number, to insure an equal bearing on each tie, and the ties must be spaced as shown on the plan. The bars are also numbered—No. 1 being the head-rod.

STANDARD NO. 1 SPLIT SWITCH.

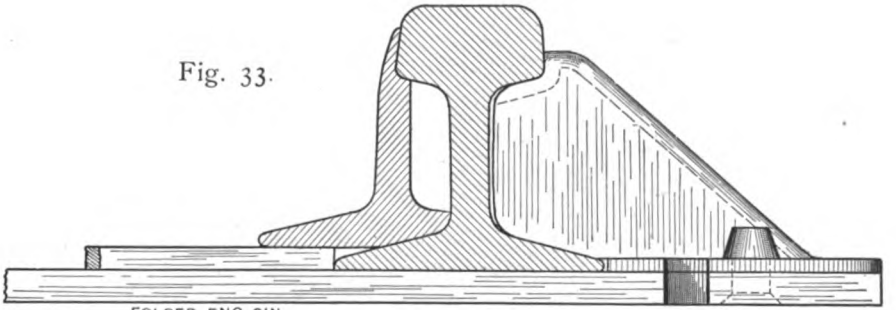
Fig. 32.



PATENTED.

STANDARD NO. 1 SPLIT SWITCH.

Fig. 33.



SECTION SHOWING BRACE AND FRICTION-PLATE.

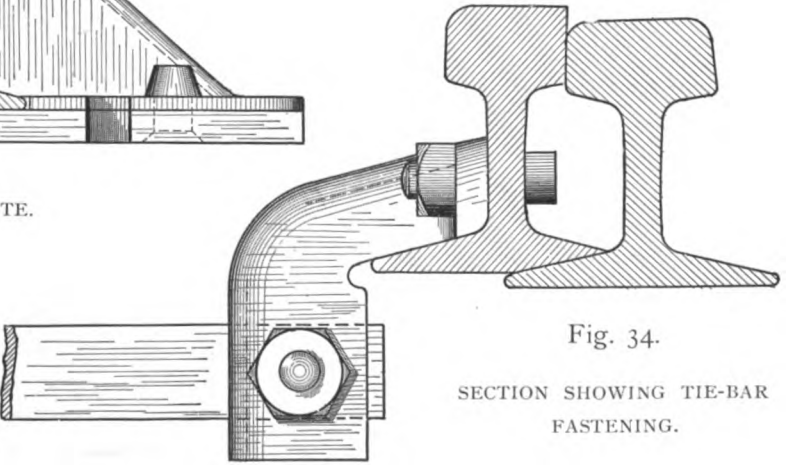


Fig. 34.

SECTION SHOWING TIE-BAR FASTENING.

PATENTED.

NEW SPLIT SWITCHES
WITH REENFORCED SWITCH-RAILS AND ADJUSTABLE HEAD-ROD.

Our latest improvements in these Switches are shown on pages 88 and 89, Each Switch-Rail is strengthened by two pieces of first-quality wrought iron riveted one on each side of the web, and running back to the angle bars about one and one-half feet from heel of switch-rail. This decreases the liability of fracture, and if the rail breaks the wrought-iron reenforcements hold the pieces together until a new rail can be put in to replace the broken one. The adjustable Head-Rod prevents all annoyance due to switch-points being slightly open. It is the practice of trackmen to take up the lost motion due to wear of parts and spread of gauge by placing nut locks on the bolts which hold the head-rod fastening to the web of the switch-rail. This is sometimes kept up until two or three washers have been placed there. It is needless to say this makes a very insecure and dangerous fastening. The shape of a nut lock is such that it makes the poorest kind of a liner, and again the shape of the switch-bar fastening is such that it is secure only when tight against web and base of the rail. The lugs which connect the switch-rails to the head-rod are bolted to the web of the rail, and the ends of the bolts are riveted over the nuts, and therefore can not be easily removed by the trackmen. With the Head-Rod shown in plan

and elevation a perfect adjustment may be obtained, and at the same time the adjusting devices are so constructed that there is positively no danger of their becoming loose due to jar of passing trains.

Since introducing these Switches we have had the benefit of the experience of the many roads using our original Design No. 1 (Catalogue No. 2), hence we improved this by one shown by Figs. 117 and 119.

You will notice no part of the rod rises above the ties; furthermore, the adjustment is complete by means of the Turnbuckle, shown in the elevation. Both threads of this Turnbuckle are right-hand, so that the adjustment is not effected by meddlesome persons who may tamper with the buckle. To adjust the points, it is necessary to disconnect the Switch-Stand Connecting-Rod, and remove the bolts from each of the fastenings through which the head-rod passes. Then the rod can be slipped until it is free from one fastening, and, after that, turned to give required adjustment.

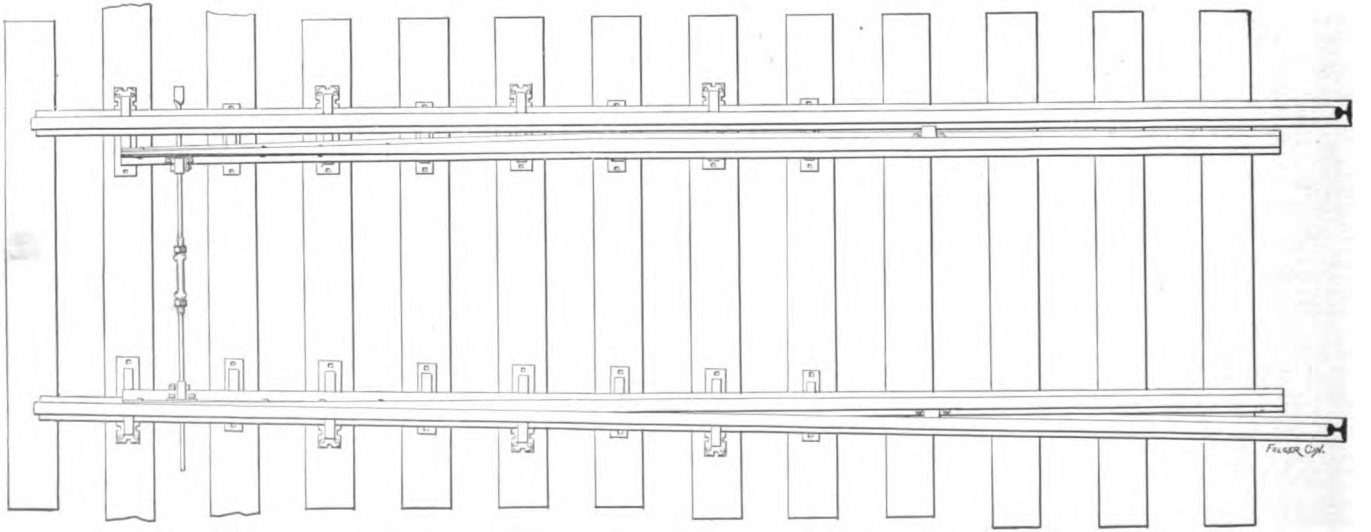
Midway between heel of switch and where the heads of the rail diverge, we place a cast stop-lug, which is bolted to the switch-rail and bears against the web of the stock-rail. This keeps the switch-rail in perfect line. The rail-braces and the friction-plates are the same as those of Split Switch No. 1, Figs. 32, 33, and 34.

These Adjustable-Bar Switches immediately meet with the favor which we anticipated when we introduced them, and the fact that so many other manufacturers have attempted to imitate them is evidence that they are a decided improvement in Switches.

It will be noticed that we show a single bar connecting the switch-rails. We feel justified in saying that this is all that is necessary when we have the knowledge that all first-class English railways use but one bar in their split switches, and this practice is illustrated in the Saxby and Farmer new catalogue.

SPLIT SWITCH, WITH REENFORCED POINTS AND ADJUSTABLE HEAD-ROD.

DESIGN NO. 2. Fig. 117.



FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

SPLIT SWITCH, WITH REENFORCED SWITCH-RAILS AND ADJUSTABLE HEAD-ROD.

DESIGN NO. 2.

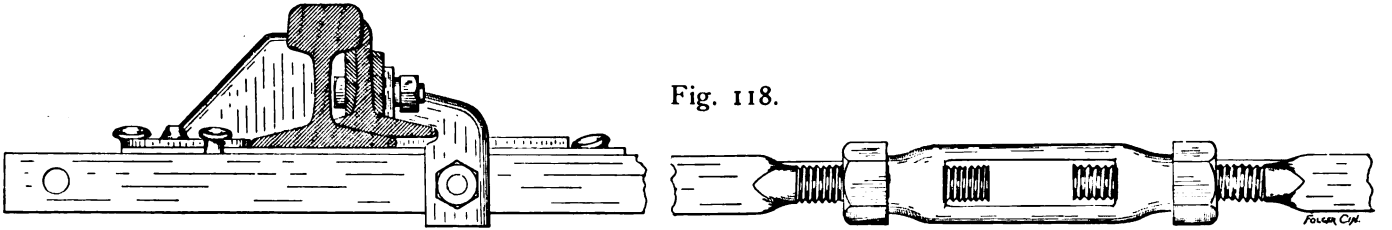


Fig. 118.

SECTION SHOWING ADJUSTABLE HEAD-ROD AND REENFORCED POINT-RAIL.

We show this in plan and section, showing the reenforced point and turn-buckle. We use extra heavy Die-Formed Steel Clips of the same general pattern as those furnished with our Split Switch No. 1, and the head-rod, which is also extra heavy, is vertical.

See general description, pages 86 and 87.

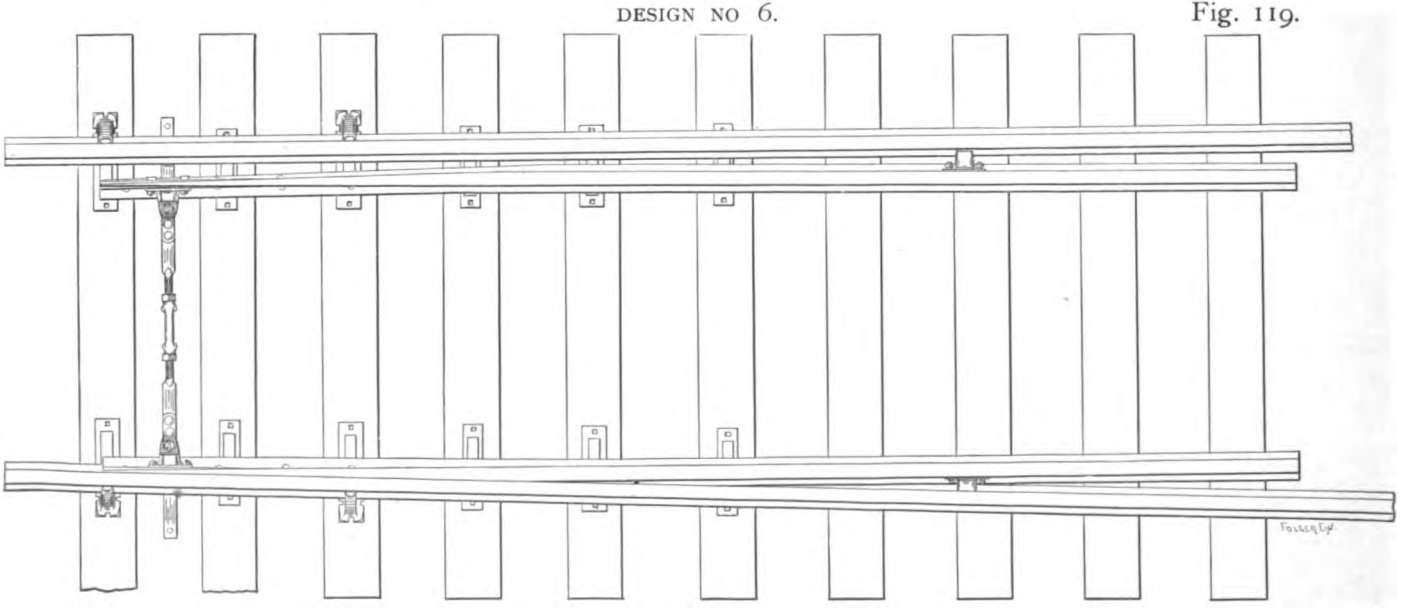
SPLIT SWITCH, WITH ADJUSTABLE HEAD-ROD AND REENFORCED SWITCH-RAILS.

DESIGN NO. 6.

This differs from Design No. 2 only in the fact that the head-rod is flat instead of on edge. The adjusting device is the same, but the rail-fastenings and connections are different. The rails are reenforced in the same way. The stop lugs are used, and the rail-braces and the friction-plates are the same as those of Split Switch No. 1, Figs. 32, 33 and 34.

SPLIT SWITCH, WITH ADJUSTABLE HEAD-ROD AND REENFORCED SWITCH-RAILS.

DESIGN NO 6. Fig. 119.

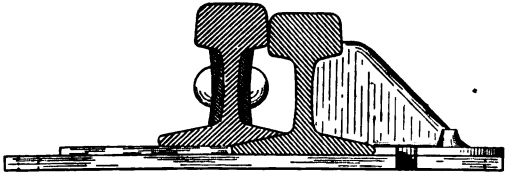


FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

SPLIT SWITCH, WITH ADJUSTABLE HEAD-ROD AND REENFORCED SWITCH-RAILS.

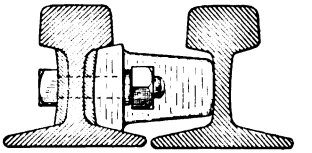
DESIGN NO. 6.

Fig. 120.



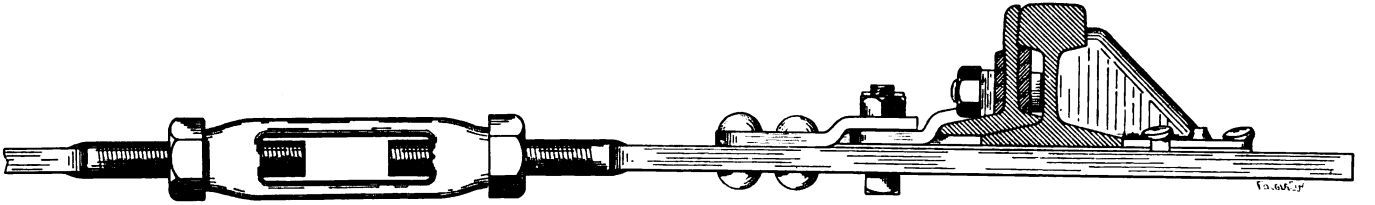
SECTION SHOWING REENFORCED POINT AND COMBINED BRACE AND FRICTION-PLATE.

Fig. 121.



SECTION SHOWING REENFORCED POINT AND CAST STOP-LUG.

Fig. 122.



SECTION AT POINT SHOWING ADJUSTABLE HEAD-ROD AND FASTENING.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

PLAIN SPLIT SWITCH.

DESIGN NO. 2.

In this Switch we have kept the Clarke-Jeffrey method of planing the rail, also the steel switch-bar fastenings and bars, and the steel base-plates for such friction-plates as have braces riveted to them, but have abandoned the ½" steel base-plate under all other friction-plates, which we simply cut to the required length and punch the spike holes, then depend upon the ties to hold up the thin friction-plates and switch-rail in place. The only object of this is to make a lower-priced switch. It is seldom wanted, but we show it in comparison with our Standard No. 1. The friction-plates and bars are numbered, and must be put in the track according to number, starting in each case at the point of the Switch.

PLAIN SPLIT SWITCH.

DESIGN NO. 2.

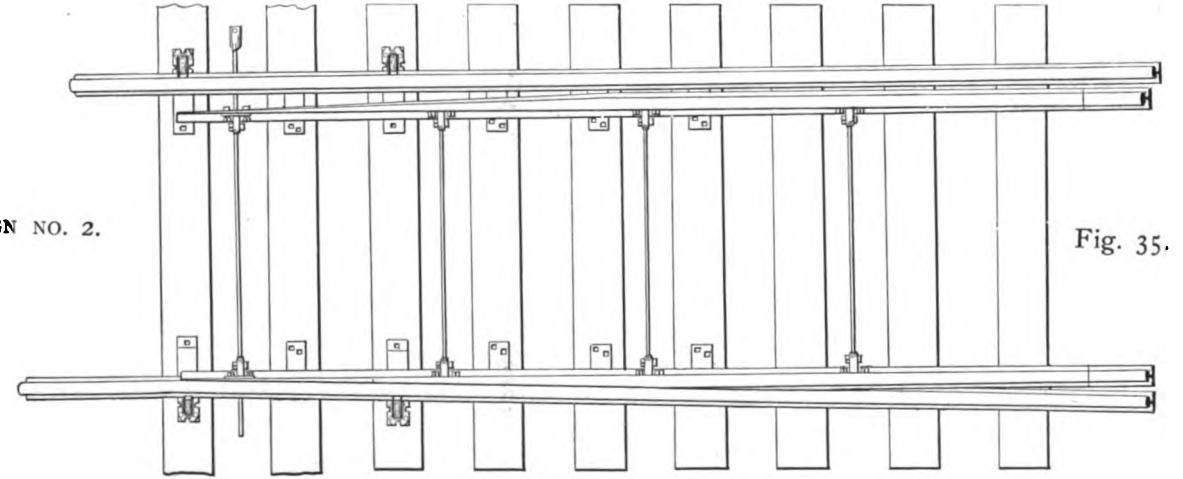
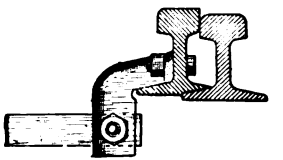
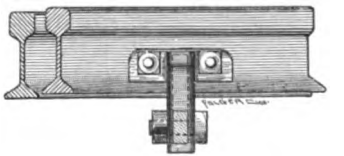


Fig. 35.





PATENTED.

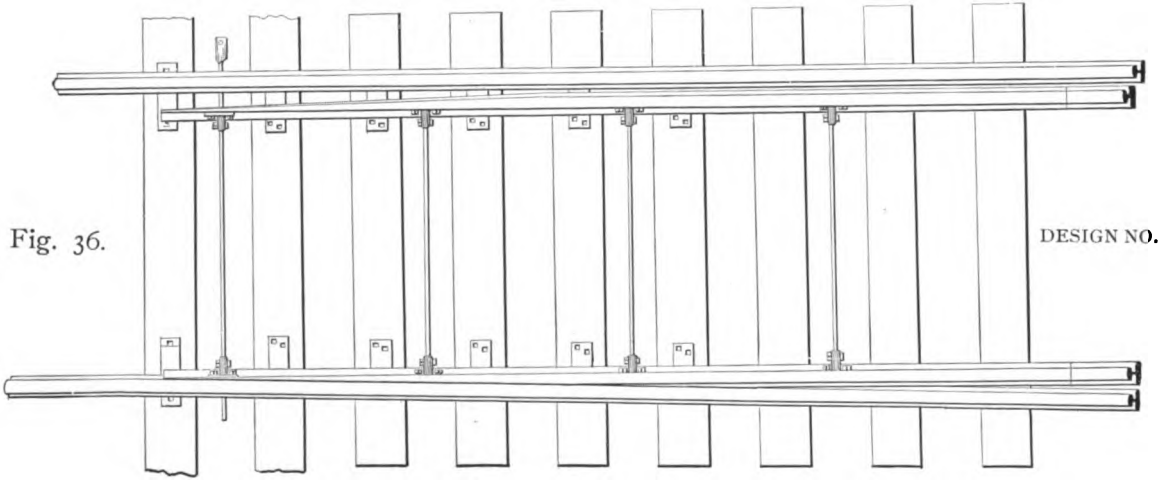
PLAIN SPLIT SWITCH.

DESIGN NO. 3.

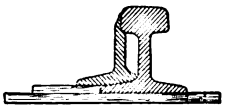
We do not furnish any braces with the friction-plates of this Switch or use the ½″ steel base-plates, except for friction-plates on the first tie. We do use, however, the steel switch-bar fastenings, and plane the rails the same as all other Switches we make. This design is for a cheaper article than either the No. 1 or No. 2, and is shown for purpose of comparison. As with the other Switches, be sure to put the friction-plates and bars in the order in which they are numbered.

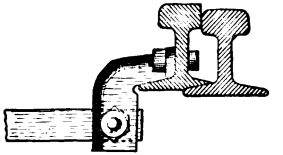
PLAIN SPLIT SWITCH.

Fig. 36.

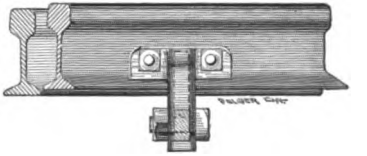


DESIGN NO. 3.





PATENTED BAR FASTENING.



THREE-RAIL SPLIT SWITCH.

We show here a Three-Rail Switch for use of double-gauge tracks. We equip these point rails with steel die-formed bar-fastenings, rail-braces, and friction-plates, the same as are used on our Standard No. 1 Split Switch. In ordering Split Switches for three-rail tracks, care should be taken that the middle switch rail is on the correct side of the center line. The small diagrams show the two styles which cover all possible cases of switch points, but for the Frogs required there are eight possible cases. For instance, Three-Rail Split Switch No. 1 will fit a track when the center line of the narrow-gauge track is on the left-hand side of the center line of the standard-gauge track, whether the turnout is to the right or to the left, and Three-Rail Split Switch No. 2 will fit a right-hand or a left-hand turnout, provided the center line of narrow-gauge track is on the right-hand side of center line of standard-gauge track.

THREE-RAIL SPLIT SWITCH.

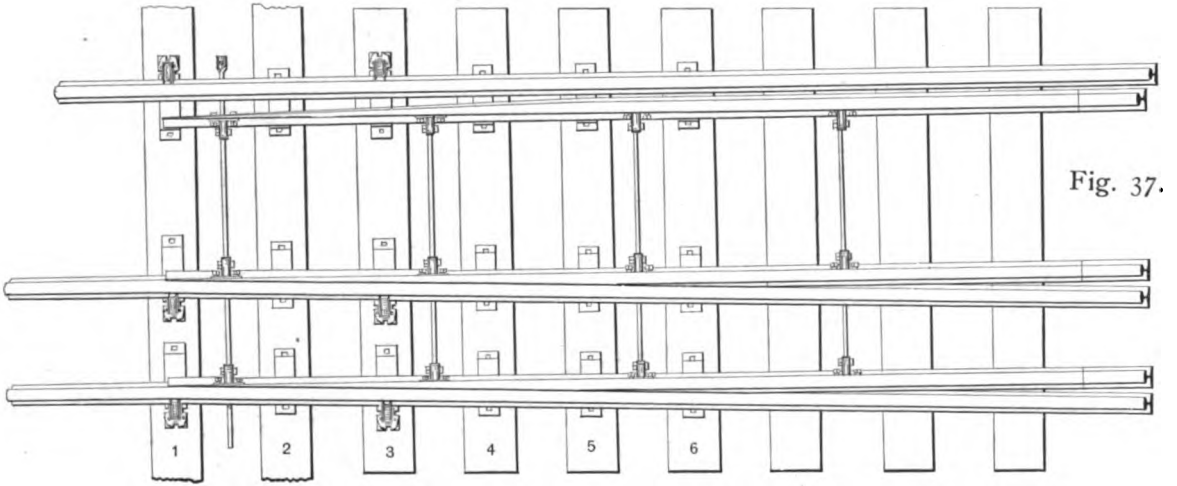


Fig. 37.

THREE RAIL SPLIT SWITCH NO. 1.

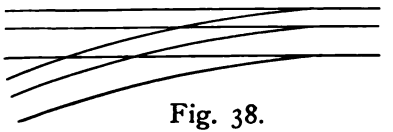


Fig. 38.

THREE RAIL SPLIT SWITCH NO. 2.

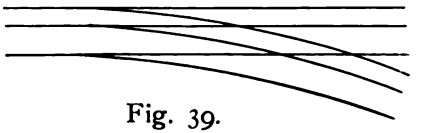


Fig. 39.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

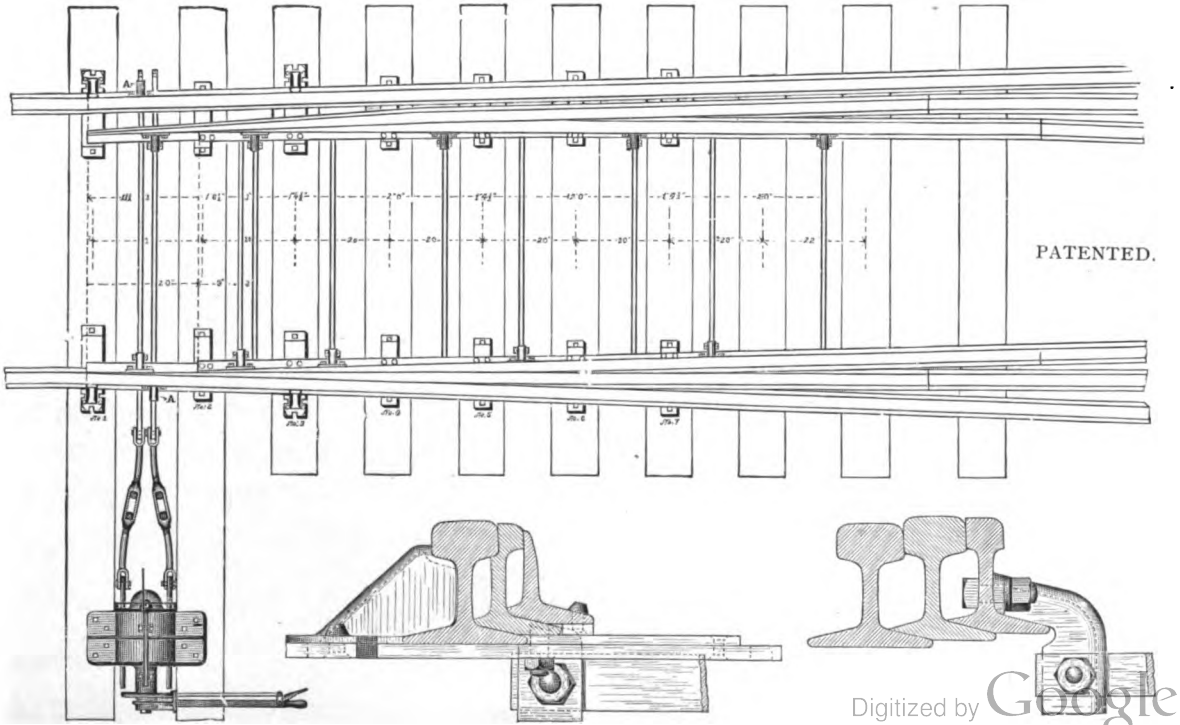
THREE-THROW SPLIT SWITCH AND STAND.

We have shown this in plan and section, Fig. 40. We believe that we have the simplest and most complete Three-Throw Split Switch and stand in the market. The switch rails are designed to preserve all the strength of the rail which it is possible to save. The steel switch bar-fastenings, braces, and friction-plates are the same as those furnished with our Standard No. 1 Split Switch. The Stand (a large cut of which is shown on page 121, Fig. 49), is the only *low-target ground-throw Stand* for Three-Throw Split Switches in the market.

Special attention is called to the use of turnbuckles in the connecting-rods, making adjustment easy and positive. We equip this Switch with the adjustable head-rods shown by Fig. 119 when desired.

THREE-THROW SPLIT SWITCH AND STAND.

Fig. 40.



PATENTED.

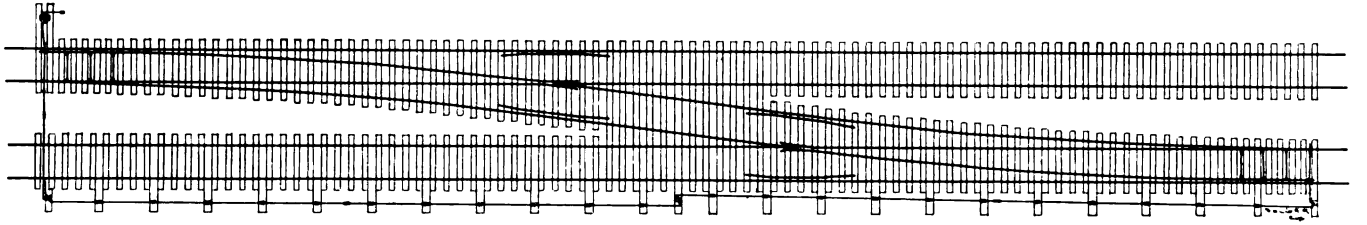
SWITCH-THROWING DEVICE FOR CROSSOVERS.

We show here in plan an arrangement for throwing both switches of a Crossover simultaneously with one single-lever Stand. This is done by gas-pipe throwing-rods, bell cranks, pipe carriers, and a compensator in the center to equalize the expansion of the pipe. Turnbuckles are also provided in the center of each length of pipe, by means of which perfect adjustment may be obtained. This device is especially useful in crowded passenger- or freight-yards, allowing one yardman to operate a number of switches in a much shorter time than he would be able to do otherwise.

This method of throwing switches is being put to a thorough practical test in one of the busiest yards in this country, and is working to the entire satisfaction of the superintendent and yardmaster. The effort required to throw the two switches at once is not perceptibly more than that required to move one.

SWITCH-THROWING DEVICE FOR CROSSOVERS.

Fig 41.



SWITCH-STANDS.

We are prepared to furnish any or every kind of Switch-Stand necessary to a railroad—from the low plain Ground-Throw without a target, to the High Automatic-Clutch Stand with twenty-foot target and ladder. In all our high Stands the crank-shafts are bent from one piece of wrought iron, and without a weld from the top to the bottom. The journal-bearings are all bored and the shafts turned, so that there is a minimum amount of lost motion in the parts.

The throw of all our stands is five inches (5″), and we always furnish connecting-rods (Fig. 52, page 125) with them. The forked end of the connecting-rod is made to fit a switch head-rod ¾″ thick, and using a ⅞″ pin. We will equip them with special targets and lamp-fittings, if so ordered.

NON-AUTOMATIC SWITCH-STANDS.

U. P. HIGH STAND.

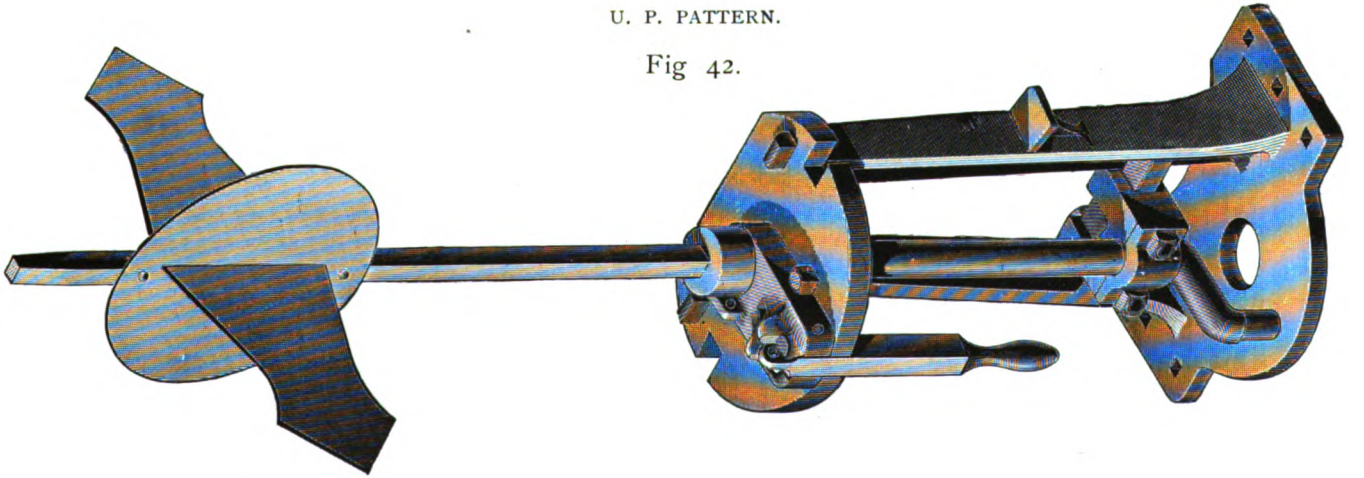
The advantage of this Stand is, that when the connecting-rod is in place on the crank there is no possibility of its coming off without taking the Stand apart. It can be used on either one or two ties. Attention is also called to the simplicity of the locking device, and the arrangement for securing the padlock chain. All this is shown on the exhibit plainer than words will describe it. The lever casting has a square tapered hole in it, and is driven on the crank-shaft very tight, and then securely held by driving a ½" iron pin through the two.

We can furnish them at such prices that every road can afford to use them. They are strong, durable, and simple, and not likely to get out of order, and the best low-priced Stand in the market.

NON-AUTOMATIC HIGH SWITCH-STAND.

U. P. PATTERN.

Fig 42.



PONY SWITCH-STAND.

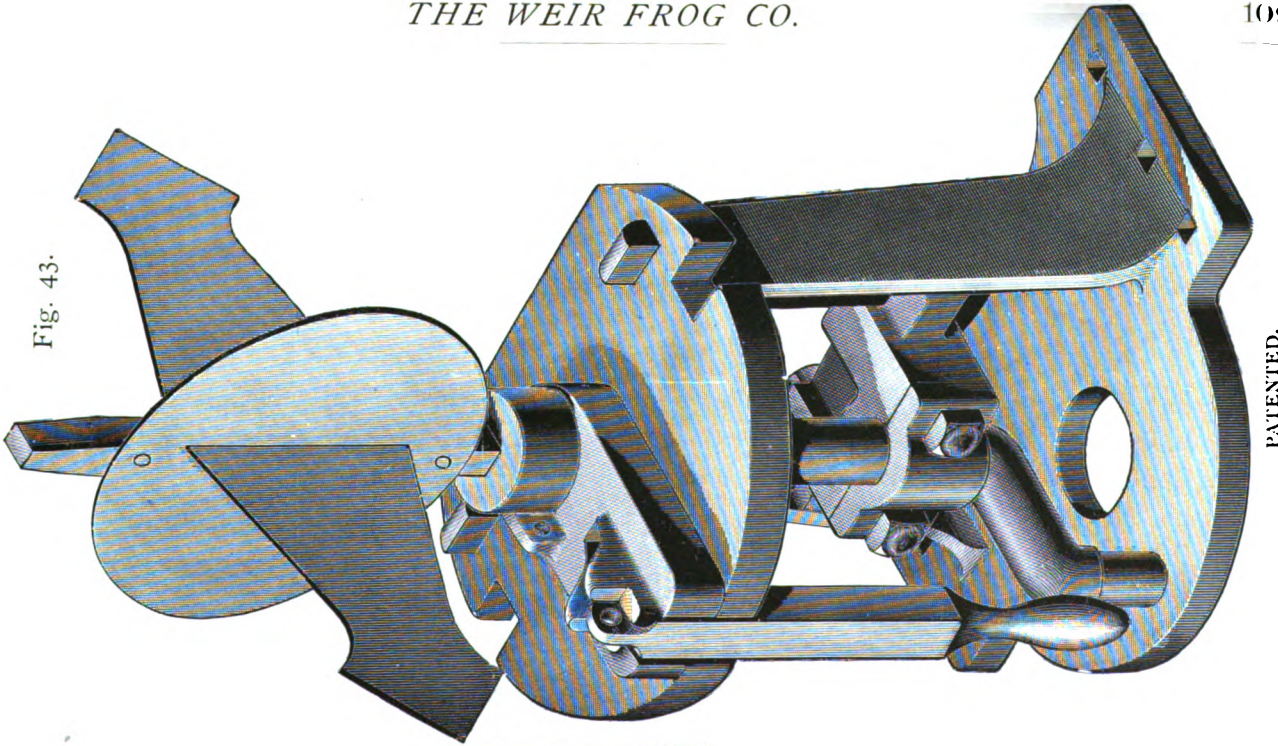
U. P. PATTERN.

This Stand is the same as the U. P. High Stand (Fig. 42) in every particular of manufacture or design except the height of the handle and target above the ties. It is intended as a low stand for yard service, without coming under that class generally known as ground-throw stands.

PONY SWITCH-STAND.

U. P. PATTERN.

Fig. 43.



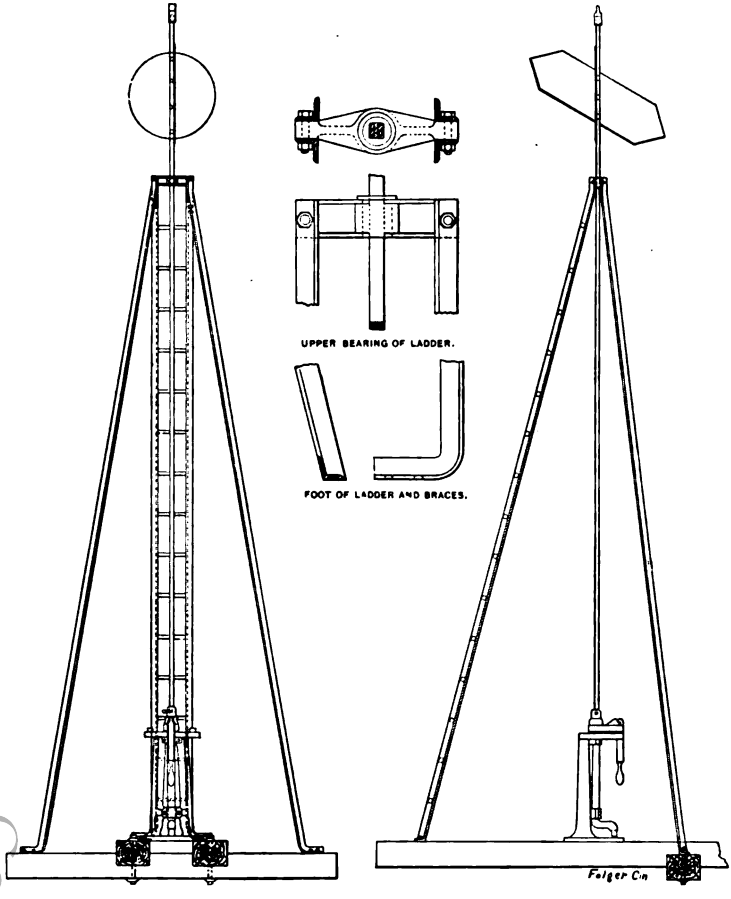
PATENTED.

STAND WITH ELEVATED TARGET.

We show by Fig. 44 a Stand equipped with twenty-foot target and ladder. The latter is made of light steel angles, by means of which we have a very light but strong structure. Any style of Switch-Stand which has a target can be used in connection with this ladder. The target is high enough above the ground to be seen over the tops of freight-cars, and also over small cuts which are on curves. By the use of this the locomotive engineer is sure of the position of the Switch, which he otherwise could not see.

STAND WITH ELEVATED TARGET.

Fig 44.



PATENTED.

TARGET-THROWING ATTACHMENT FOR THREE-THROW HIGH STANDS.

(FOR USE WITH STUB SWITCHES.)

When the main track is in the center of a three-throw turnout the target of an ordinary Three-Throw Switch-Stand works all right, showing red for each side track and white for the main track, but when the two turnouts are on the *same side* of the main line, then, with an ordinary Stand, if the main track has a white target, the first turnout will have a red one, but the second turnout will have a white one. By the use, however, of the attachment shown (Fig. 45), both of the turnouts will have red targets and lights, and the main track alone a white target. The device is extremely simple and cheap, and the target-shaft locked in every position. We can, when necessary, equip the Three-Throw Split-Switch Stand also with this arrangement. This device can be used either for right- or left-hand turnouts, and with the Stand on either side of the track, although it may be necessary to change the idle quarter of the gears by turning them upside down, in order to bring a white target for the main line, and red targets for each turnout.

TARGET-THROWING ATTACHMENT FOR THREE-THROW HIGH STANDS.

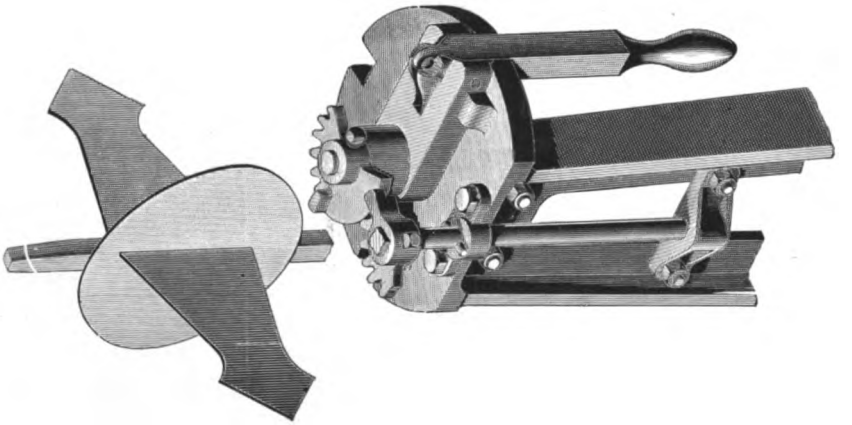


Fig. 45.

AUTOMATIC SWITCH-STANDS.

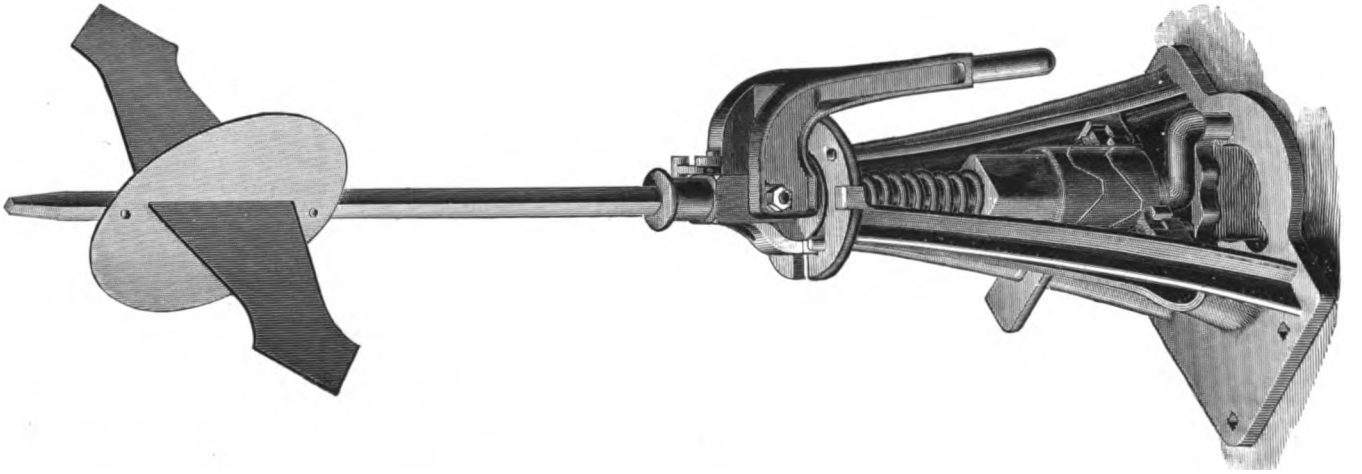
We are making an Automatic-Clutch Stand which possesses some entirely new and desirable features (Fig. 46), the most important being the Three-Part Clutch, with faces of different inclination. The weak point of all Automatic-Clutch Stands heretofore used is that they are apt to leave the switch point partially open after the train has run through the switch. This is due to the following reasons: First: The clearance between gauge of car-wheels and gauge of track, which varies from one quarter of an inch to one and a half inches, allows a chance for the wheel flange *not* to force the point rail up tight against the stock rail. This makes it imperative to use a Stand which will be sure to do what the wheel flange may not do. Second: If a Stand having clutch faces of equal inclination is used, with a spring powerful enough to force the clutches together, and by this means close the point up tight, then the resistance offered by the spring to separate the clutch and open the switch for the passage of trains becomes so great that there is great danger of bending or breaking the switch rail. In this Stand we overcome these difficulties, and have a device which offers a comparatively slight resistance to opening the switch rail by the wheel flange, but when the point is within an inch of the stock rail, the spring forces the clutches together, closing the point up tight against the stock rail.

AUTOMATIC HIGH STAND.

Besides the advantage of using a three-part clutch (see page 115), there are one or two others worth mentioning. The Stand can be used either on one or two ties, and the target-shaft can be turned to suit the track. The connecting-rod can not be taken off the crank without unbolting the bottom bearing and lifting the crank-shaft, and the crank and shaft are one piece of wrought iron with long, carefully fitted bearings and joints to reduce wear. There is no strain on the spring when the switch is thrown by hand, and the handle can not be dropped unless the switch rail is tight against the stock rail, nor can the Stand be padlocked unless the handle is down, but the Stand is automatic whether padlocked or not. Another advantage is the large diameter of clutches which reduces possible lost motion to a minimum, and the three-part clutch insures a double life to this part of the mechanism and Stand. A positive stop has been added to the top of the Stand, so that the handle can not be thrown too far or in the wrong direction, and the padlocking device has been changed so that no strain can come on the hasp of the lock if the handle is raised when the lock is in place.

AUTOMATIC HIGH STAND.

Fig. 46.

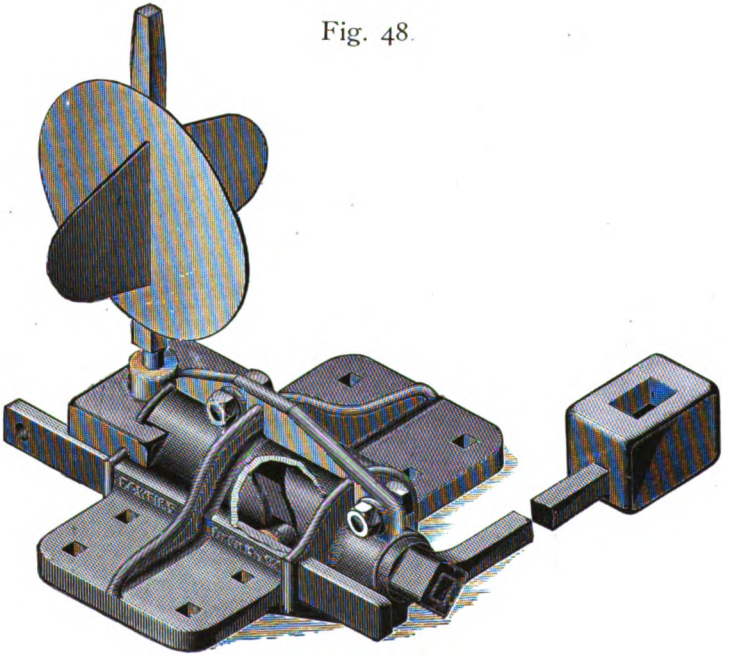


AUTOMATIC GROUND-THROW STAND.

This Stand when not padlocked is automatic without the use of a spring or clutches. The handle is weighted and throws parallel to the track, while the action of the sliding bar is direct, without angular movement. This is accomplished by the barrel with the spiral groove in which works the steel friction roller that is placed on the pin of the sliding bar. The action of this Stand is simple and positive. It is entirely closed so that it is not affected by the weather, unless, of course, it should be under water; but when the ties are kept properly drained around it, it can always be depended upon, as it will never freeze, and no dirt can get into it. The target is acted upon by the gear on end of barrel-shaft, the office of which is simply to turn the target. In the casing opposite the set-screw of the target is a screw plug. By removing this plug and using the small socket wrench which is furnished with the Stand, the set-screw can be slackened and the target set to the position required after the stand is spiked down. The whole arrangement is simple, strong and durable. We are furnishing large numbers of these with short targets for yard purposes, and with higher targets when desired to be used on the main line. They are as perfect and durable a device as will be found on the market.

AUTOMATIC GROUND-THROW STAND.

Fig. 48.



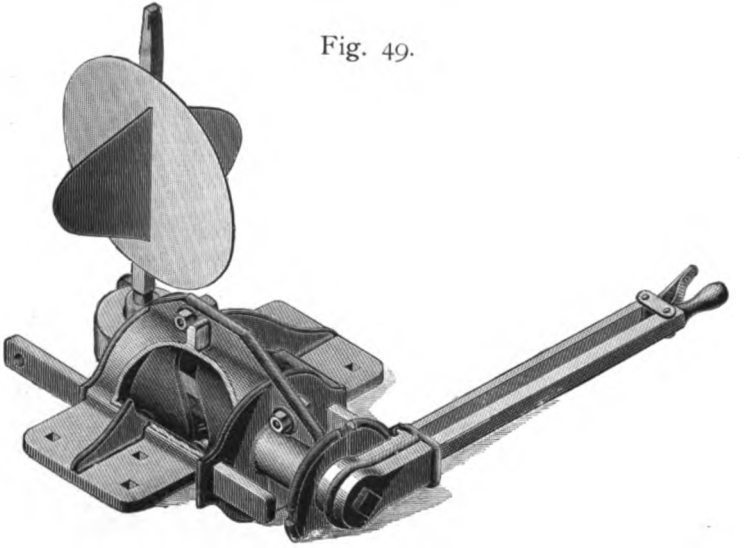
PATENTED.

THREE-THROW SPLIT-SWITCH STAND.

As we previously stated, this is the only Low-Target Ground-Throw Stand for Three-Throw Split Switches in the market. It is wonderfully simple in its construction, and at the same time very positive in its action. The handle has a spring locking bar which fits in the notches on the locking-plate, which is part of the housing of the Stand. The target can be arranged to throw for both turnouts on the same side of the main line, or for one turnout on each side, if we are informed upon which side of the track the Stand is to be placed, and on which side the turnouts are. The general design is the same as that of our Automatic Ground-Throw Stand, but this Stand is not automatic in either position. We do not believe a single-lever three-throw split-switch stand can be made automatic, and at the same time be reliable.

THREE-THROW SPLIT-SWITCH STAND.

Fig. 49.



PATENTED.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

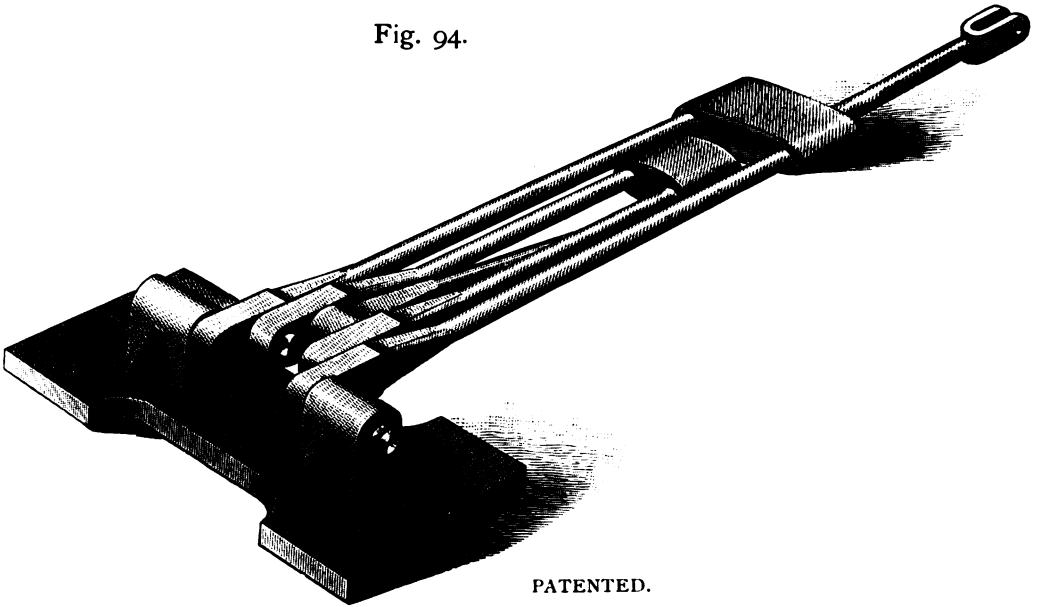
GROUND THROW FOR THREE-THROW STUB SWITCHES.

Fig. 94 represents the only style of Three-Throw Stand for Stub Switches which in all positions has its handles flat on the ground. The extreme height of the base casting is 5″, and the other parts are still lower. Either one of the double handles may be thrown to move the switch rail into the middle position, and then by throwing the remaining one the switch rail is moved into its second position. By throwing both at once a double throw is made, and the switch rail moved from one extreme to the other extreme position. This Stand is especially useful in yards where Three-Throw Stub Switches are occasionally required, and where a Stand which is much above the ground is an obstruction.

A target attachment can be added to this if desired, but for the uses to which it would be put we do not think it essential.

GROUND THROW FOR THREE-THROW STUB SWITCHES.

Fig. 94.



PATENTED.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

SWITCH-FIXTURES.

Fig. 51 represents a plain Ground Throw, of which we have two sizes: for light and heavy rail. The crank and handle are wrought iron, and all bearings are turned and drilled to insure a perfect fit.

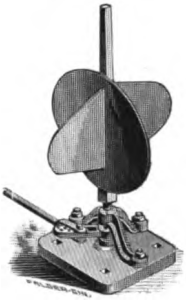
Fig. 96 shows our new Target Ground-Throw Stand with a housing enclosing the gears which throw the target

Our Connecting-Rods, Fig. 52, are made of 1⅜″ round iron. The eye which fits on the Switch-Stand Cranks is made by wrapping a piece of 2″ x ¾″ iron around a mandrel, and welding the ends to the 1⅜″ round bar, after which the hole is carefully drilled and reamed. The forked end is made of 2½″ x ¾″ iron welded in the bar, and a ⅞″ inch pin-hole drilled through it.

We make two styles of Tie-Bars for Stub Switches—one with the lips riveted to the bar, and the other a solid die-formed forged bar, as shown by Figs. 53 and 54.

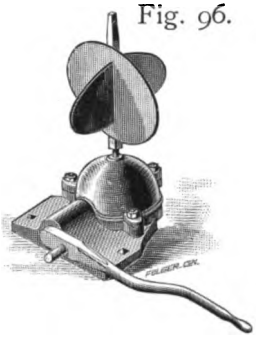
Fig. 95 represents a Target- and Lantern-Stand for use at switches, operated by interlocking or by ground throws having no target.

Fig. 95.



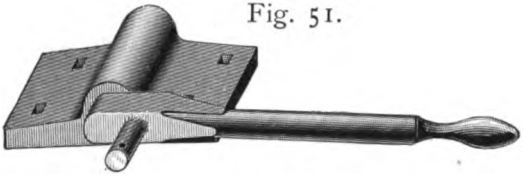
TARGET-STAND.

Fig. 96.



GROUND-THROW WITH TARGET.

Fig. 51.



PLAIN GROUND-THROW.

Fig. 53.

RIVETED TIE-BAR.

Fig. 54.

FORGED TIE-BAR.

Fig. 52.

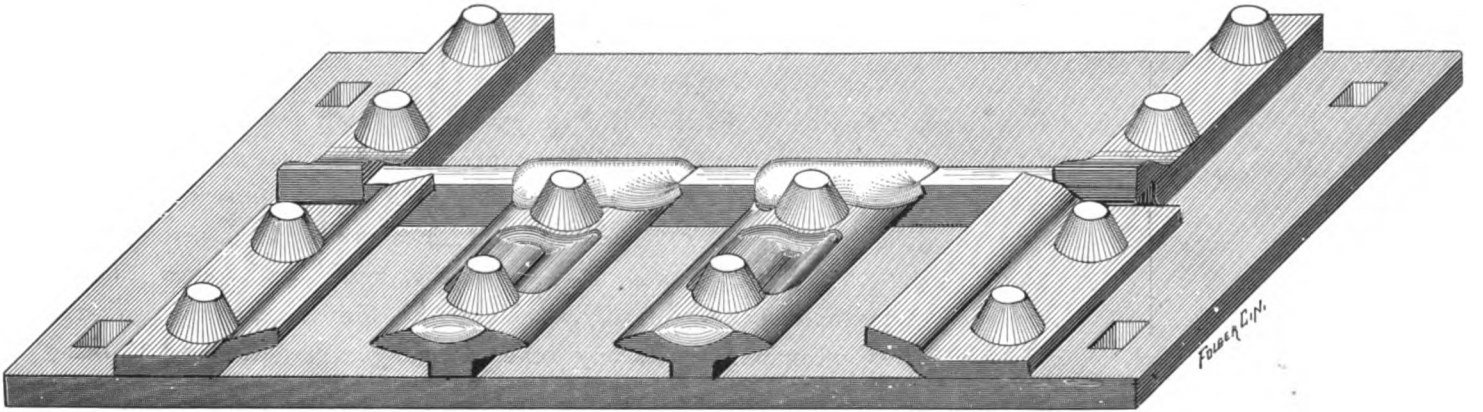
CONNECTING-ROD.

STEEL-PLATE HEAD-CHAIR.

In yards where Stub Switches are still in use, and Head-Chairs are required, we can thoroughly recommend the Steel-Plate Chairs, shown by Fig. 55. They are indestructible, and the plates being steel and generally $\frac{11}{16}$" thick, they furnish abundant supporting power for the switch rail, so that the plate does not buckle, nor does it destroy the elasticity of the switch joint, thereby preserving the life of the switch rail, because the thickness of it does not make an anvil of the switch joint to hammer out the rails. They have been adopted by every leading road in the country that has ever tried them, and when once they have commenced the use of them, they have never failed to continue it. There are probably from forty to fifty thousand of these Head-Chairs in use, which alone is sufficient recommendation as to their merits The cut shows a Double Chair, but we can furnish single ones as well.

STEEL-PLATE HEAD-CHAIR.

Fig. 55.



PATENTED.

STEEL DIE-FORMED RAIL-BRACES.

We are the pioneers in the manufacture of Die-formed Wrought-Iron or Steel Rail-Braces, having started the business about eleven years since, and following it up step by step until we have arrived at our present standard of excellence, and the Brace we now make has been specially commended by one of our strongest competitors as being the best design yet produced. It is made of homogeneous plate steel, and so formed as to furnish parallel vertical sides. These vertical sides are bridged across under the head of the rail to strengthen them at the point where it engages the under and outer sides of the head of the rail. These vertical sides, and shape generally, enable us to furnish a more rigid and a stronger Brace with the given thickness of material than any other Brace yet designed, and it being of the box form, fits over the one spike in the tie, and then being secured with three spikes makes a very rigid support. We make these for any height or shape of rail and in six different designs, and are prepared to make them in any quantities. We formerly made, and do yet, to a small extent,

make our original Wrought-Iron Brace of iron, 3½" wide and ⅝" thick, but the steel is regarded so much superior that it is crowding this Wrought-Iron Brace entirely out of use. It is not our policy to talk much about patents, but we wish to say in connection with our Rail-Brace that it has been examined by eminent patent attorneys and decided to be different in principle of construction from any other Brace in the market, and the Patent Office, having acknowleged its merit, granted us a patent which is not an infringement upon any existing valid patent. The fact that over 2,000,000 are in use by the leading railroads of the country is the best evidence of its merits. We are rapidly increasing this number since

Our CAPACITY IS 24,000 BRACES PER DAY.

STEEL DIE-FORMED RAIL-BRACE.

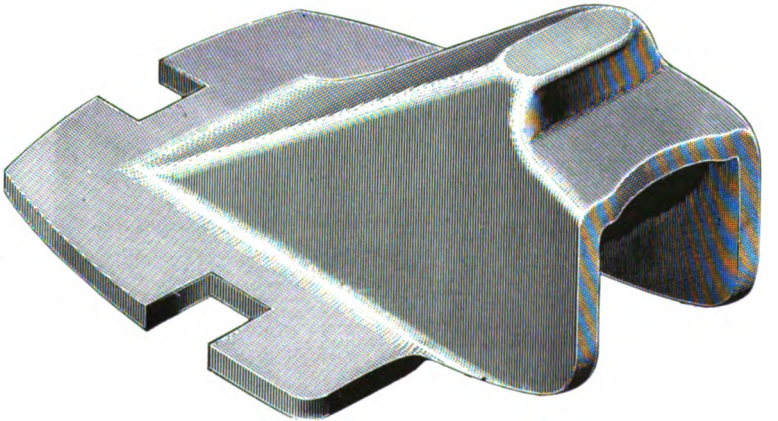
DESIGN NO. I.

This is made of steel ¼" thick, and the spike holes are on the edge of the tie-bearing flange, and are open. See description, pages 128 and 129.

STEEL DIE-FORMED RAIL-BRACE.

DESIGN NO. I.

Fig. 56.



PATENTED.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

STEEL DIE-FORMED RAIL-BRACE.

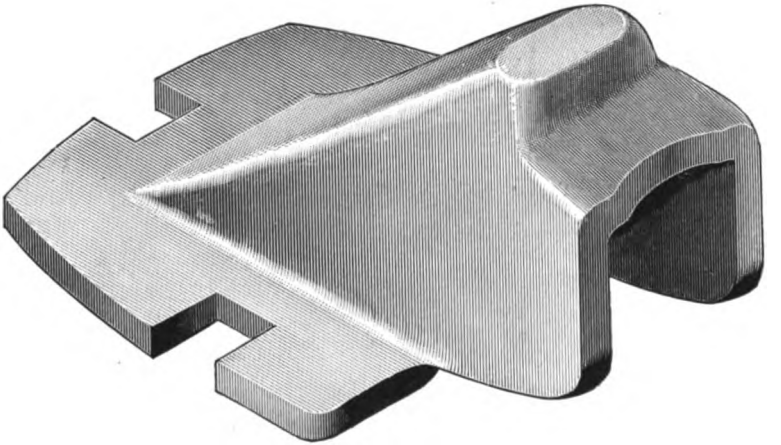
DESIGN NO. 2.

This Brace is the same as Design No. 1, except it is made of heavier steel, being $\frac{5}{16}$" thick. See remarks, pages 128 and 129.

STEEL DIE-FORMED RAIL-BRACE.

DESIGN NO. 2.

Fig. 97.



PATENTED.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

STEEL DIE-FORMED RAIL-BRACE.

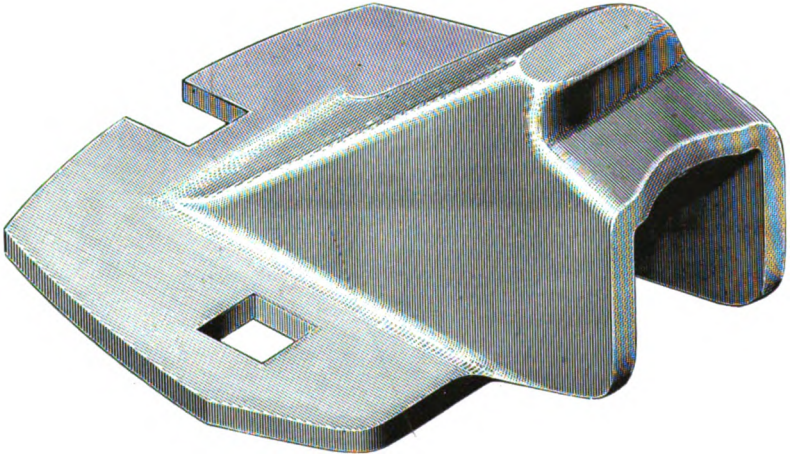
DESIGN NO. 3.

It is a medium-sized Brace, having the two spike holes which are nearest the base of the rail enclosed, and the one at the back end open. It is made of ¼" metal. See description, pages 128 and 129.

STEEL DIE-FORMED RAIL-BRACE.

DESIGN NO. 3.

Fig. 57.



PATENTED.

STEEL DIE-FORMED RAIL-BRACE.

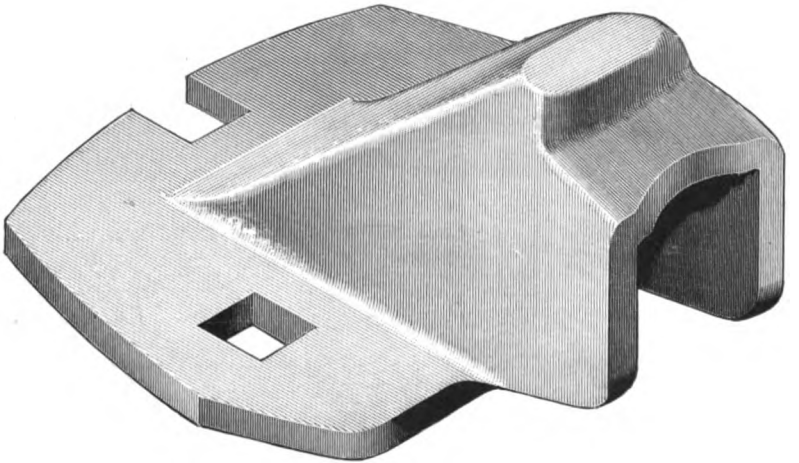
DESIGN NO. 4.

Is the same shape as Design No. 3, but made of heavier metal, being $\frac{5}{16}$" thick. See pages 128 and 129 for general description.

STEEL DIE-FORMED RAIL-BRACE.

DESIGN NO. 4.

Fig. 98.



PATENTED.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

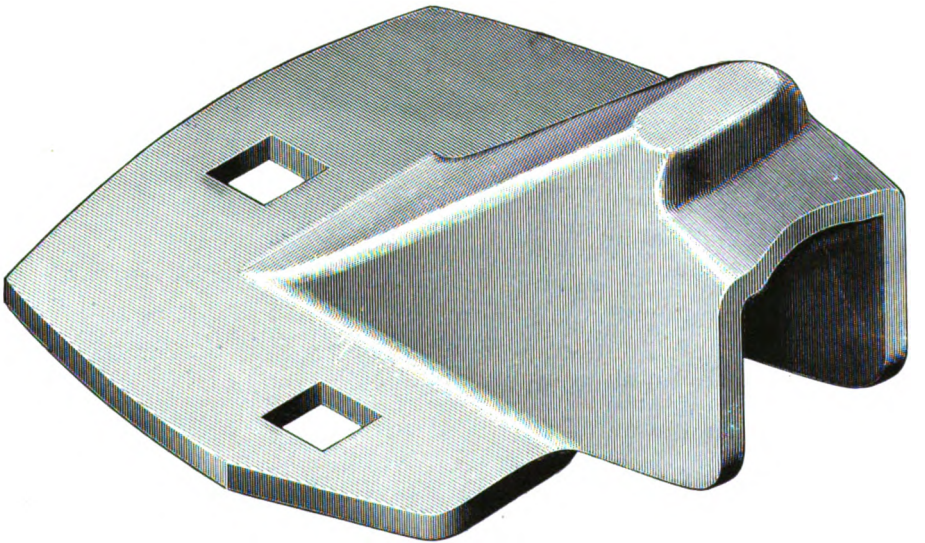
STEEL DIE-FORMED RAIL-BRACE.

DESIGN NO. 5.

This design shows all spike holes surrounded with metal, thus furnishing a larger base. It is made of steel ¼" thick. See pages 128 and 129.

STEEL DIE-FORMED RAIL-BRACE.

Fig. 99.



DESIGN NO. 5.

PATENTED.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

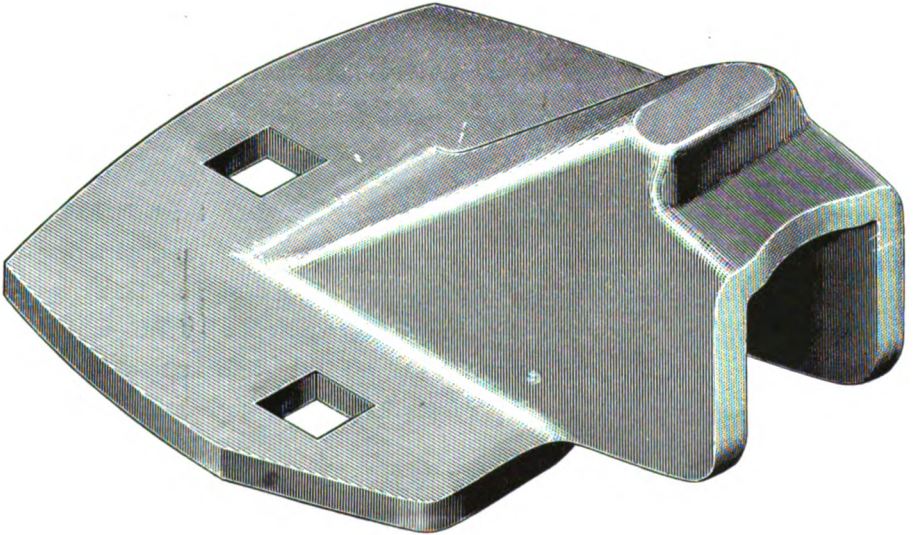
STEEL DIE-FORMED RAIL-BRACE.

DESIGN NO. 6.

The same Brace as No. 5 in all particulars except weight. It is made of $\frac{5}{16}$" steel. See general remarks, pages 128 and 129.

STEEL DIE-FORMED RAIL-BRACE.

Fig. 58.



DESIGN NO. 6.

PATENTED.

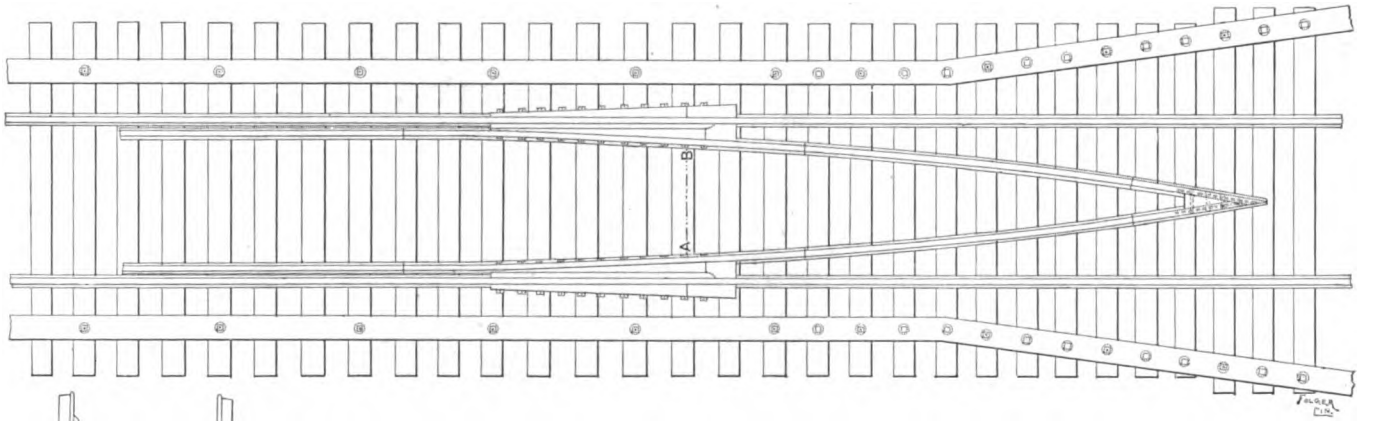
FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

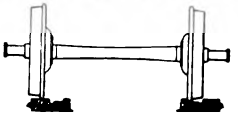
BRIDGE-GUARD.

We illustrate on opposite page our plan of Latimer Bridge-Guard. We furnish the point of the Guard and the rerailing castings with a piece of guard-rail bolted to them. This leaves the railroad company to complete the work by cutting in filling rails between point and rerailing castings, and then continue the guard-rails beyond as far as they deem fit. We have designed these rerailing castings with considerable care, and we know that they will do the work required of them under any conditions where a Wrecking-Frog will replace a truck. In fact, we have positive information in regard to instances where derailed cars have been replaced while the train was running at a high rate of speed.

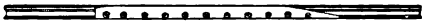
BRIDGE-GUARD.

Fig. 59.





SECTION ON A. B.



SIDE VIEW OF CAR REPLACER.

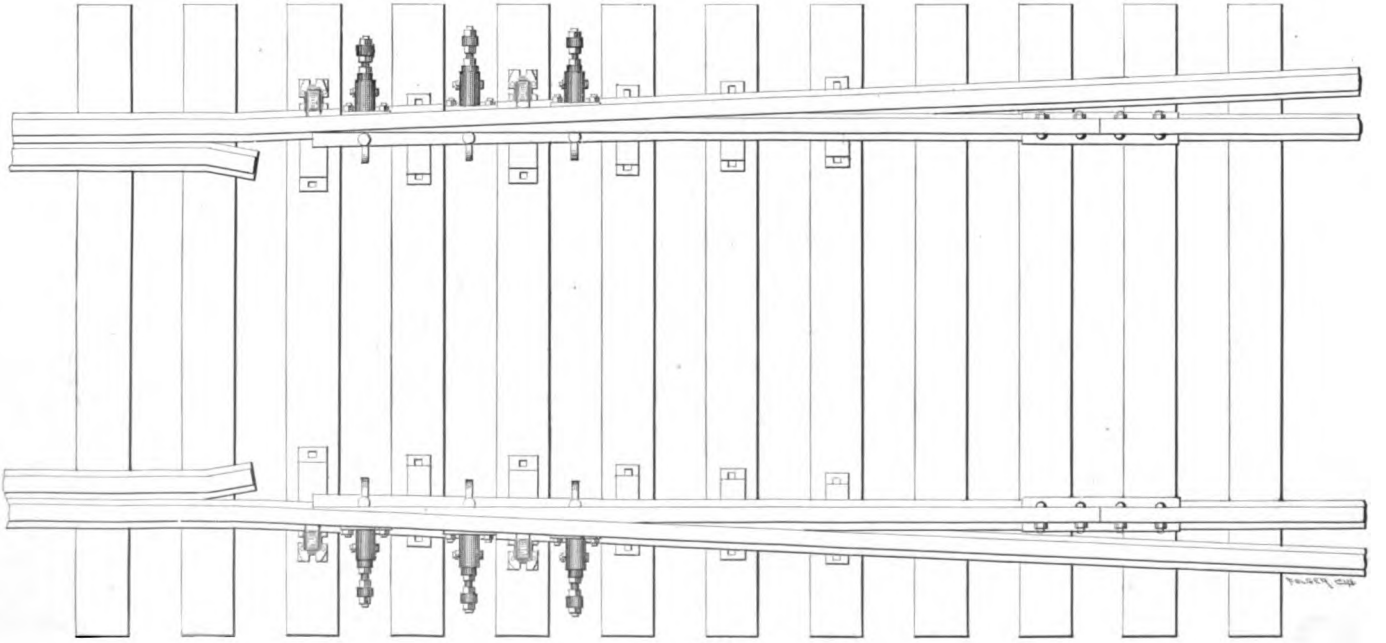
SIDE VIEW OF GUARD POINT.

EXPANSION JOINT.

Fig. 61 shows our patented Expansion Joint, to be used at the ends of bridges where the creeping and expansion of the rails must be compensated for. By starting with the gauge a trifle wide, considerable expansion can be taken care of before the gauge becomes too tight so be safe. The spring clamps which are shown in side and end view in Figs. 62 and 63 will keep the disconnected points up tight against the bent rails, and at the same time Friction-Rollers and Springs permit a free longitudinal movement. Wherever this joint has been tried it has given satisfaction, and we can recommend it as efficient, safe and durable.

EXPANSION JOINT.

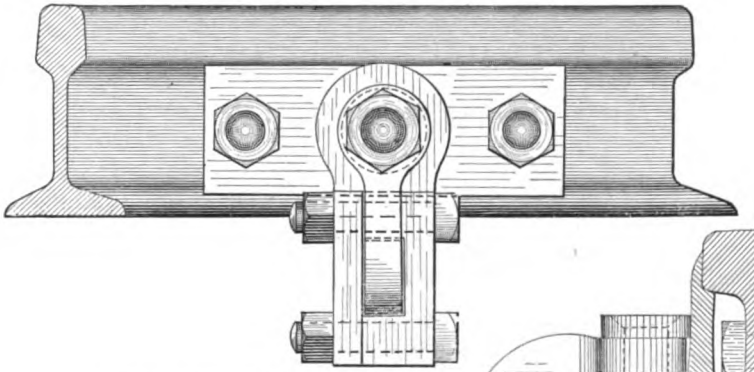
Fig. 61.



PATENTED.

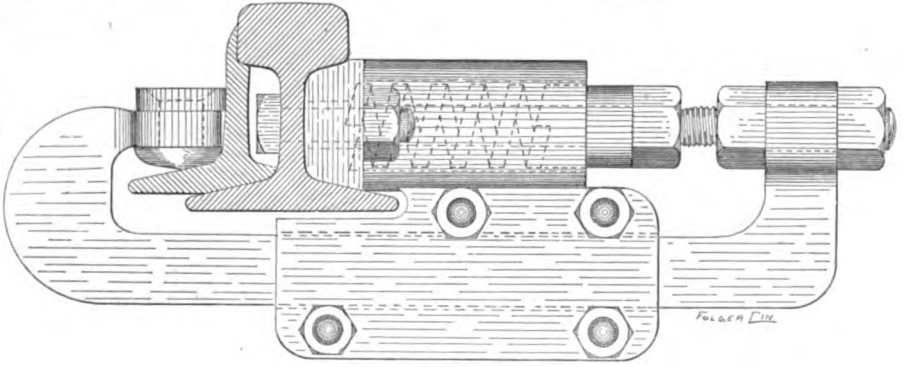
EXPANSION-JOINT DETAILS.

Fig. 62.



END VIEW OF SPRING CLAMP.

Fig. 63.



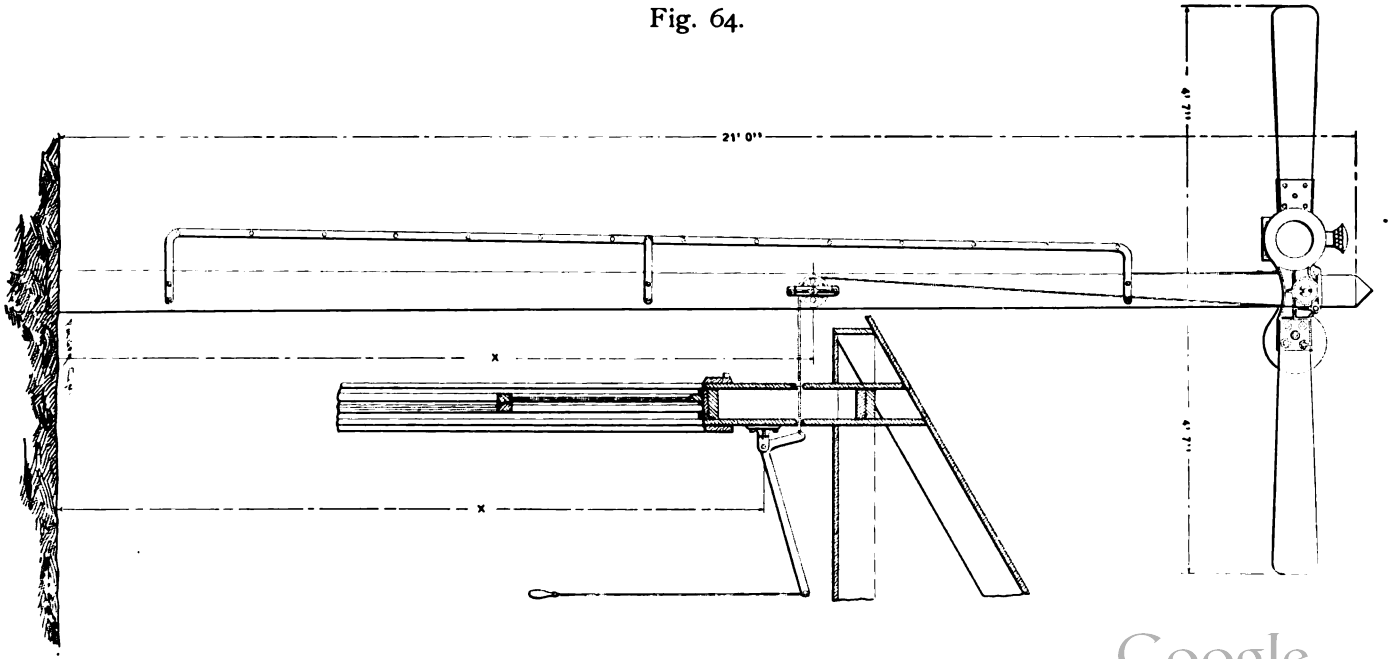
SIDE VIEW OF SPRING CLAMP.

DOUBLE SEMAPHORE-ARM STATION SIGNAL.

We are prepared to make this Station Signal for roads which use the block system of running trains. The arms are counterweighted and the pivot is out of center, so there can not be a position in which the arm will not go back to "Danger" when released. It can be operated any distance from the station. The Red Lenses are 8″ in diameter, and all the parts are fitted carefully, so that it is an excellent Station Signal. The distances marked "X" on the cut can be changed to suit the height of the station.

DOUBLE SEMAPHORE-ARM STATION SIGNAL.

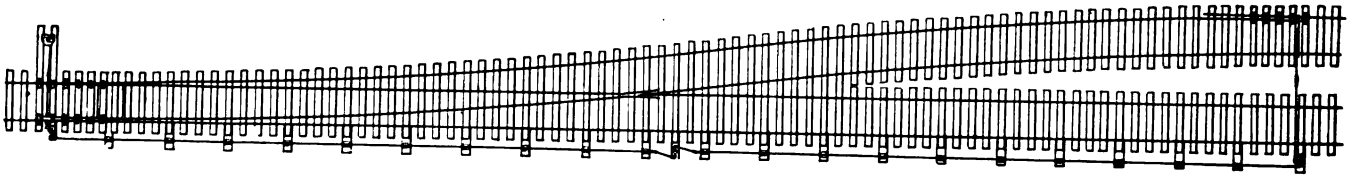
Fig. 64.



DERAILING SAFETY SWITCH FOR SPUR TRACKS.

DESIGN NO. I.

Fig. 123.



In the case of side tracks or spur tracks on grades, it is desirable to protect the main track from cars which started by the wind or some other cause, run down in the way of passing trains, thereby causing a wreck.

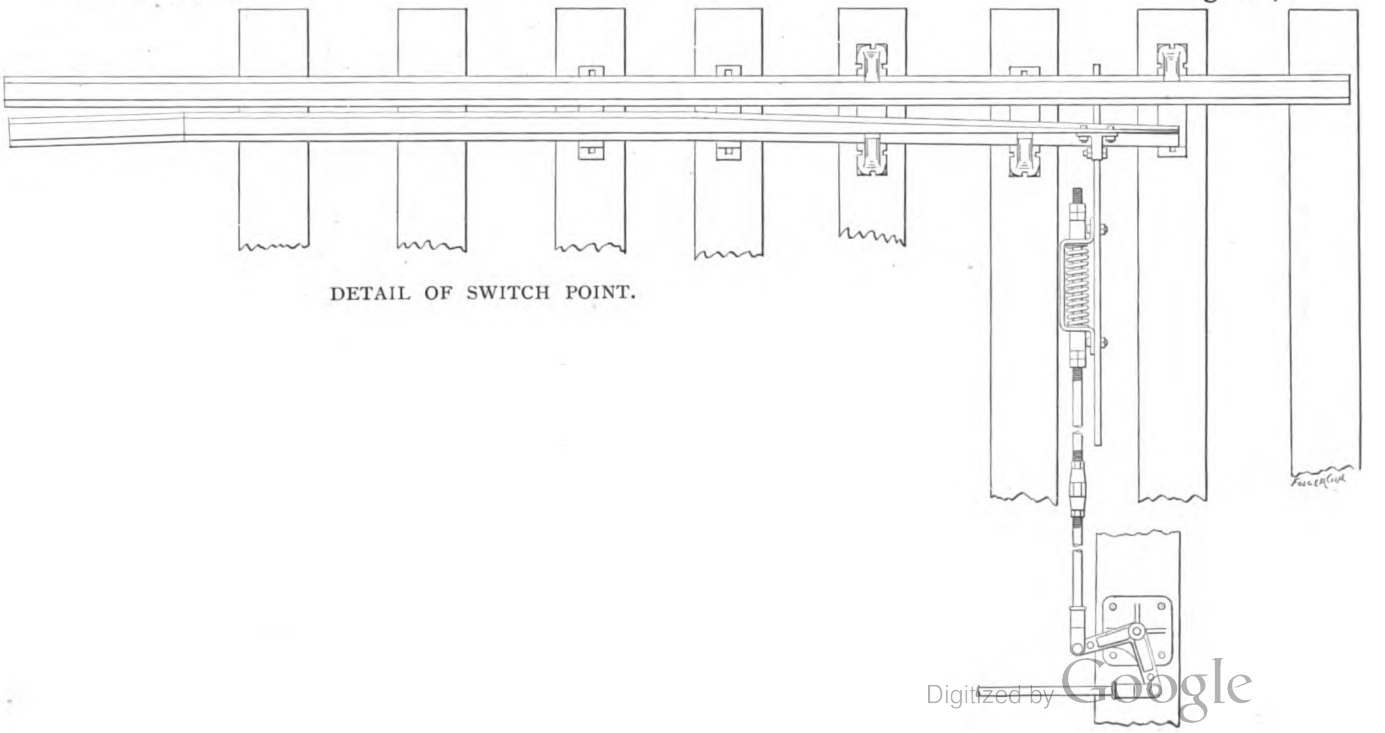
We show by Figs. 123 and 124 a Derailing Switch in plan and detail, which is operated in connection with the Switch Stand by means of a throw rod and bell cranks, as described for Fig. 41.

The Spring in the head rod of the derailing point allows a car which is entering the Switch to pass over the point, should it be open, without breaking it.

DERAILING SAFETY SWITCH FOR SPUR TRACKS.

DESIGN NO. I.

Fig. 124.



DETAIL OF SWITCH POINT.

DERAILING SAFETY SWITCH FOR SPUR TRACKS.

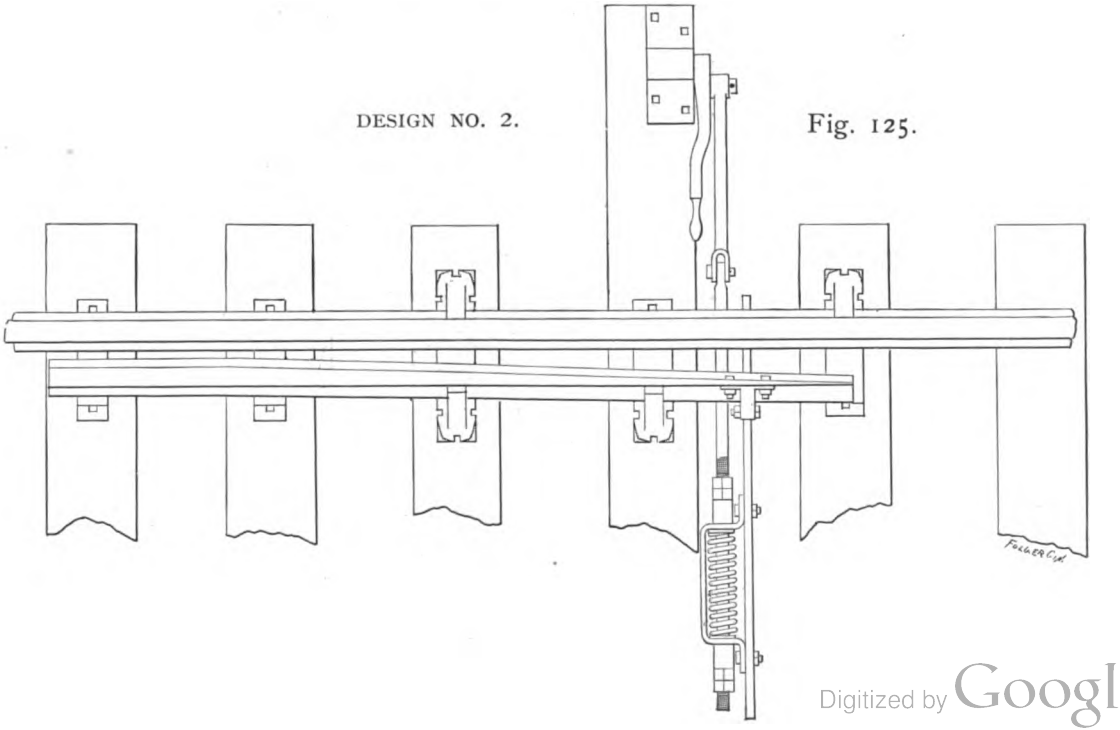
DESIGN NO. 2.

To accomplish the same purpose as the Switch shown by Fig. 124, page 151, but for a lower price, we present the one illustrated by Fig. 125. This is operated by a Plain Ground-Throw, and is independent of the Main Line Switch-Stand, otherwise it is as complete in all particulars as Design No. 1.

We especially recommend this design as worthy of trial. The point is braced on the inside, and the throw of the Stand is increased to allow a derailed wheel to pass between point and stock rail without becoming jammed and breaking the point.

DERAILING SAFETY SWITCH FOR SPUR TRACKS.

DESIGN NO. 2. Fig. 125.



DERAILING SAFETY SWITCH FOR SPUR TRACKS.

DESIGN NO. 3.

For a still lower-priced arrangement than that shown by Fig. 125, page 153, we can furnish the device shown on opposite page. For many this will be all that is required, and accomplish all that the more elaborate designs do.

We furnish Chair, Ground-Throw with Connecting-Rod, and Rail-Jaw.

DERAILING SAFETY SWITCH FOR SPUR TRACKS.

DESIGN NO. 3.

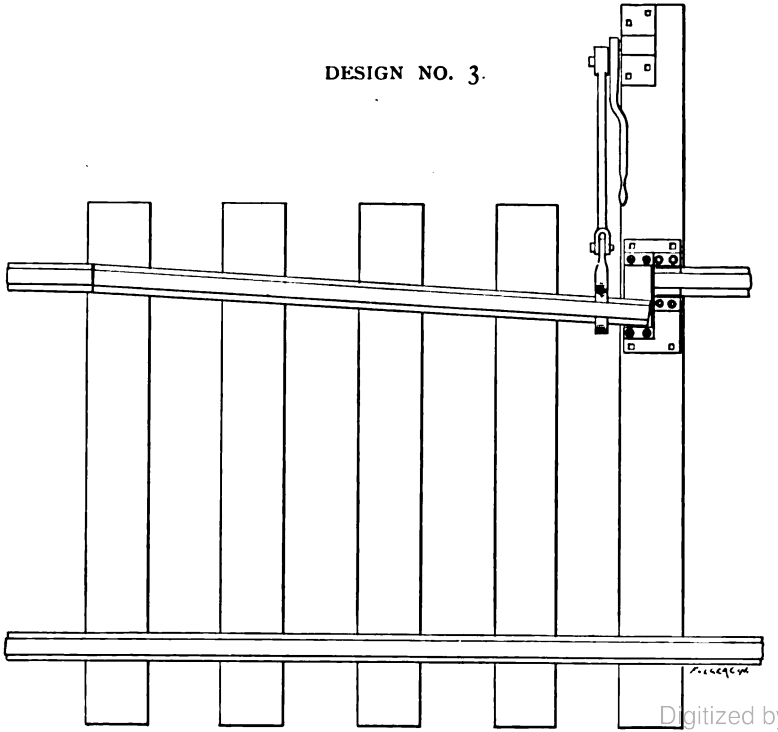


Fig. 126.

STREET RAILWAY TRACK-WORK.

We are now prepared to do work for Cable and Electric Railways, either as per plans and designs furnished by the Railroad Company, or in accordance with our own designs.

We have patterns for solid cast-steel Switches, Mates and Run-offs which require no Chairs under them, and furnish these in place of the old style of built-up construction, which is so objectionable.

Although we prefer to use light or heavy T rails, we make work of any of the so-called Girder Rails, provided the Railroad Company will furnish us with the rail to be used, whether slot rail, side-bearing, center-bearing, or guard rail.

Upon request we will cheerfully submit approval plans for any special work, either complicated or plain, and can guarantee our curved work to be without any equal in the country.

Please order special Track Work by referring to the diagrams, pages 189–203.

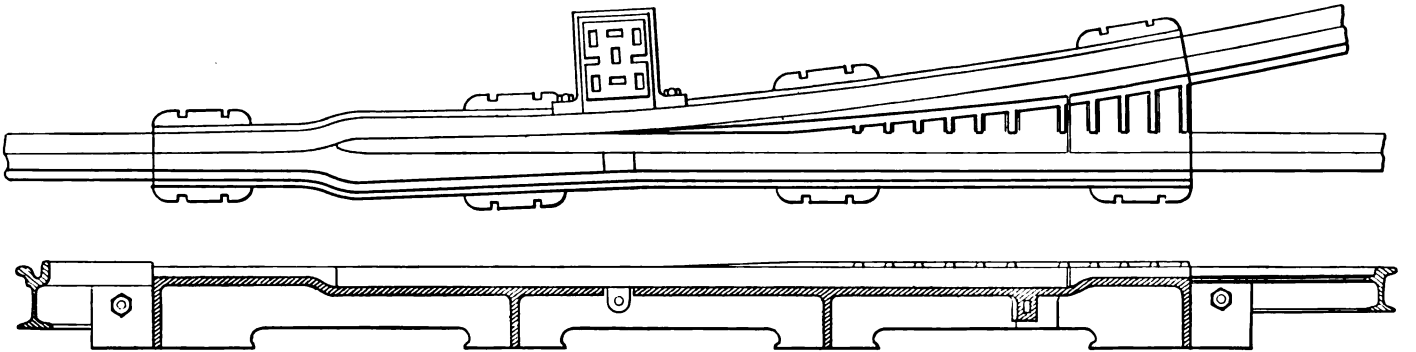
CAST-STEEL TONGUE SWITCH.

Fig. 127.

We show in plan and longitudinal section our new Tongue Switches, cast solid in one piece of open-hearth steel. They can be made with spring tongues or loose tongues as required. The body is 8″ high, and is provided with flanges by which it can be spiked directly to the ties without the use of chairs. Pockets are cast at the ends to fit the section of rail in use, whether T, Girder, or Duplex rail. The Tongue is 2″ thick, so there is no possible danger of its curling up or bending, and it is attached to the body casting in such a way that it can readily be removed without taking up the Switch. The old style of built-up switch is not substantial enough for the great weight and the increased speed and traffic of Electric cars; furthermore, the fact that all street-road work is hidden from view by the paving, so that broken bolts or rivets can not be repaired, makes it imperative to have a solid structure at this most vital part of street-road track. We consider this Switch without an equal.

CAST-STEEL TONGUE SWITCH.

Fig. 127.



LONGITUDINAL SECTION THROUGH FLOOR.

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

CAST-STEEL MATE.

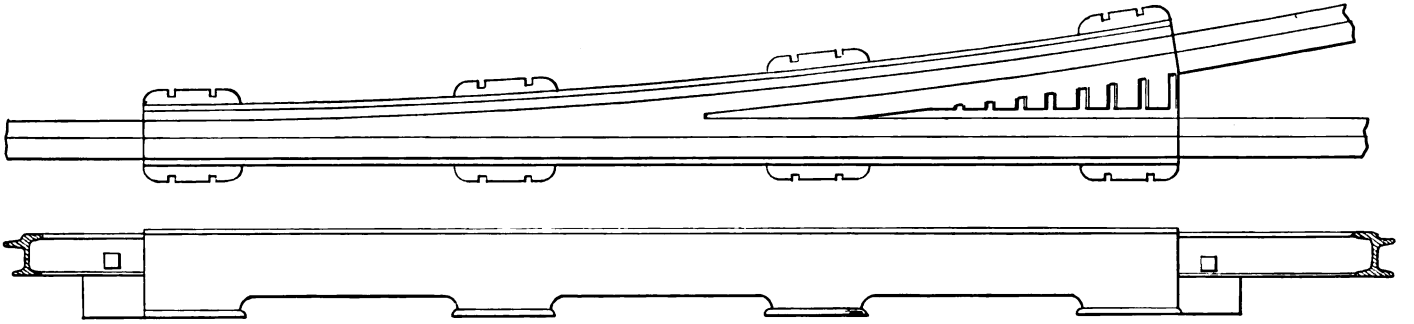
Fig. 128.

As a companion piece to the Cast-Steel Switch, Fig. 127, we show a plan and side elevation of our new solid Mate, cast of open-hearth steel. As on the Switch, pockets are cast on the ends to fit any section of rail used. This pattern is also 8″ high, and can be spiked directly to the ties without using chairs. This makes a Mate without bolts, rivets, or blocks to break or get loose, so the piece remains intact until completely worn out.

Our Run-Offs also are made in one solid piece, the same as the Mate.

CAST-STEEL MATE.

Fig. 128.



FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

T-RAIL TONGUE SWITCH AND MATE.

NO GUARD-RAIL.

The Switch (Fig. 67) is made of T rail riveted to a steel plate. The tongue rail is held down at its point by means of the bolt which passes through its web. The other end slides on the bolts between the spread fish-plates. The head of the stock rail is notched to receive the point of the tongue rail, so as to protect it against blows from the wheel-flange. The Mate (Fig. 68), which is made to match the Switch, has its point bolted to the stock rail, and the two are riveted to a steel plate. These can be made to fit any curve and gauge.

T-RAIL TONGUE SWITCH AND MATE.

NO GUARD-RAILS.

Fig. 67.

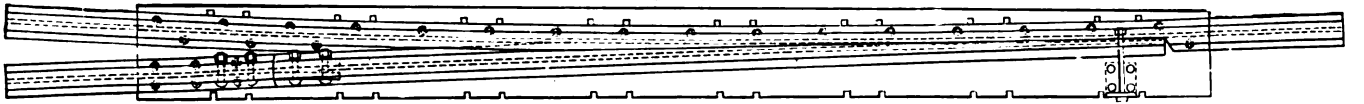
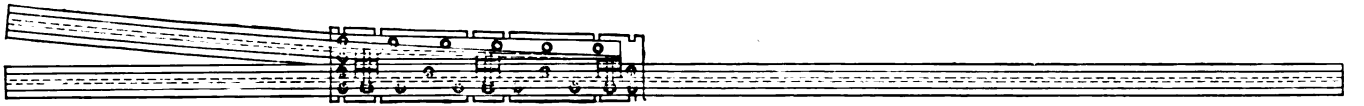


Fig. 68.



T-RAIL TONGUE SWITCH AND MATE.

WITH GUARD-RAIL.

Fig. 69 shows a Tongue Switch with a solid cast-iron filling upon which rests a forged steel tongue. An inside guard-rail is used, and the whole bolted together with fourteen ¾″ bolts. It is automatic when equipped with a spring, which is housed in a square box, with a lid which may be easily raised to tighten or loosen the spring bolt. The latter is readily removed from the box in case it is required to renew it. We have improved our method of holding the pin of the Switch-Tongue. As we now make them the tongue can be removed without taking the switch out of the track or digging the earth out from under it. All that is required is the removal of a few paving-blocks.

The Mate (Fig. 70) which goes with the Switch is made somewhat like a single-pointed Frog, and is bolted with nine ¾″ bolts. The filling is solid cast iron, faced with steel, to carry the wheel on its flange from the point to the full rail.

T-RAIL TONGUE SWITCH AND MATE.

WITH GUARD-RAIL.

Fig. 69.

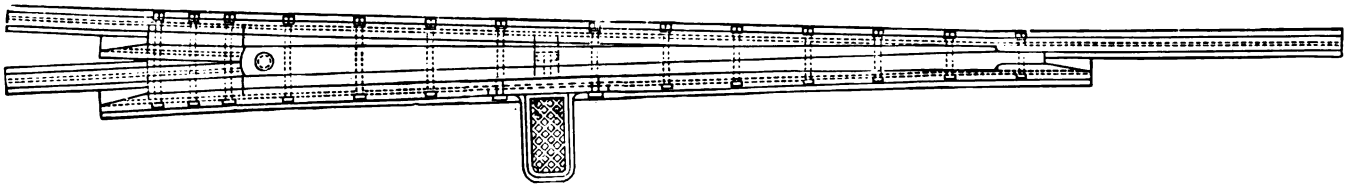
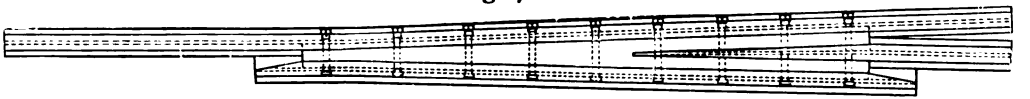
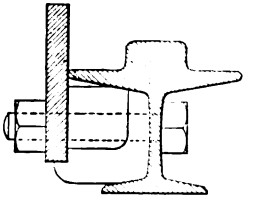


Fig. 70.



CURVED GIRDER RAIL, WITH BOLTED GUARD.

Fig. 71.



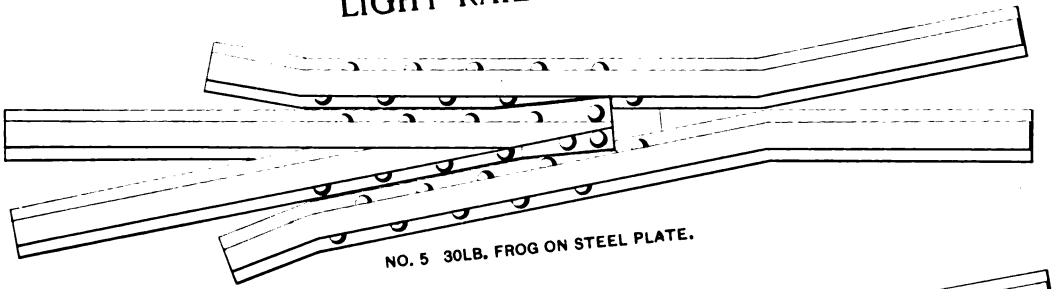
This section shows a Girder Rail with a wrought-iron Guard Iron bolted to it for use on curves This arrangement fulfills the requirements quite as well as the rolled sections of solid guard rail at a much less cost, and at the same time is better, in that the Guard Iron may be renewed without throwing away the rail itself. In making surface-road work, either of Girder or T Rail, we use this design of Guard Rail, unless otherwise ordered.

FROGS OF LIGHT T RAIL.

We show, by cuts, Frogs of rail from twelve pounds to forty pounds per yard. Filling is used with rail which is high enough to permit the use of bolts, but generally the rails are riveted to a plate. These Frogs can be made either straight or curved, and any angle desired.

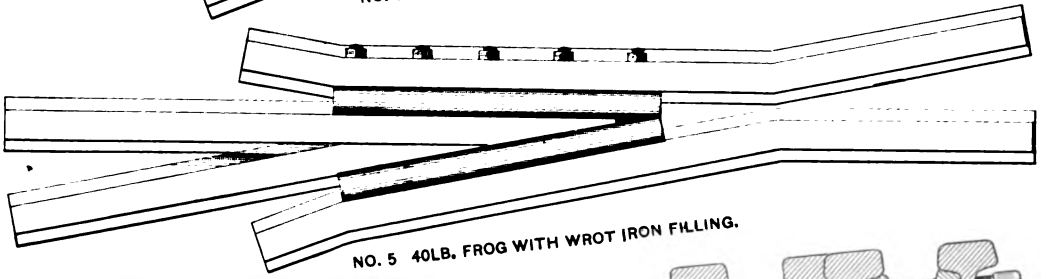
LIGHT-RAIL FROGS.

Fig. 72.

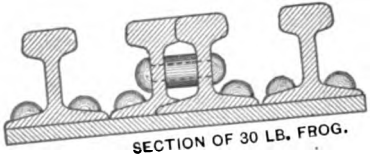


NO. 5 30LB. FROG ON STEEL PLATE.

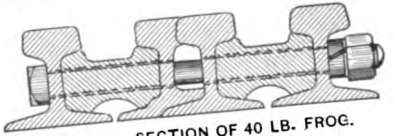
Fig. 73.



NO. 5 40LB. FROG WITH WROT IRON FILLING.



SECTION OF 30 LB. FROG.



SECTION OF 40 LB. FROG.

LIGHT-RAIL FROGS ON STEEL PLATES.

Fig. 74

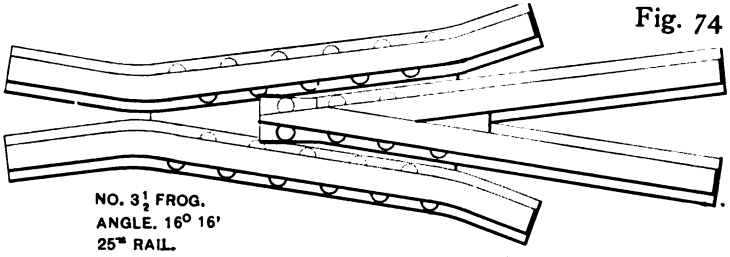


Fig. 75

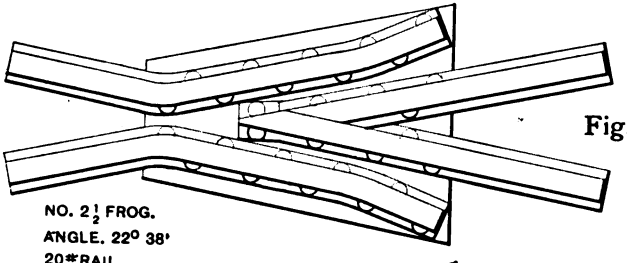
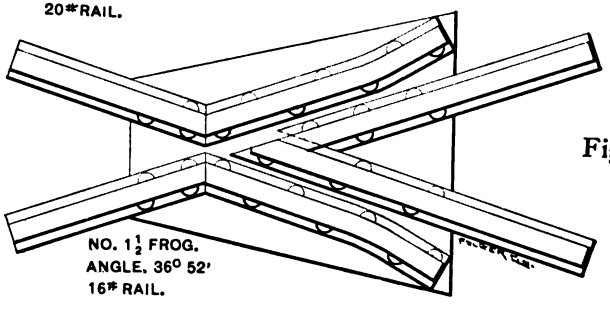


Fig. 76



THREE-THROW SPLIT SWITCH OF LIGHT RAIL.

This Three-Throw Split Switch, of 20-pound T rail, is designed for use in tracks carrying light rolling stock. The Switch is well built and substantial, and fulfills admirably the conditions for which it is required.

THREE-THROW SPLIT SWITCH OF LIGHT RAIL.

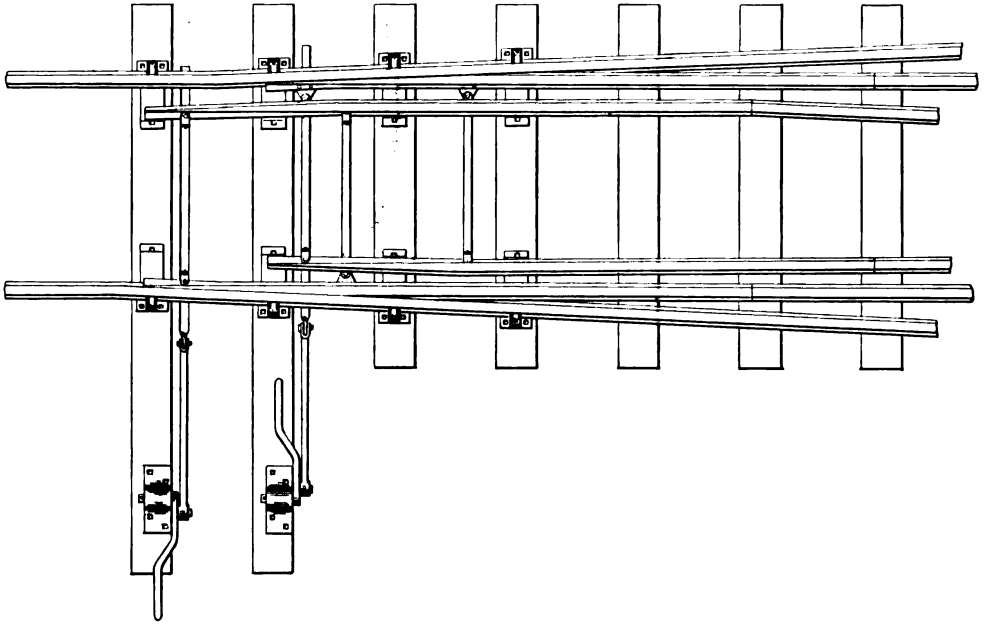


Fig. 100.

TURNOUT COMPLETE, OF LIGHT RAIL.

For semiportable track work the Turnout of 20-pound T rail is shown. All running and guard rails are bolted to steel channel ties, which are closed up at each end with a piece of angle iron. These ties readily imbed themselves in soft ground, and so resist all tendency to lateral or longitudinal movement. The switch rails are trimmed like a split switch, and the Frog is riveted to a plate as well as bolted to the steel ties. The result is a very well-designed and durable piece of light-rail work.

TURNOUT COMPLETE OF LIGHT RAIL.

Fig. 101.

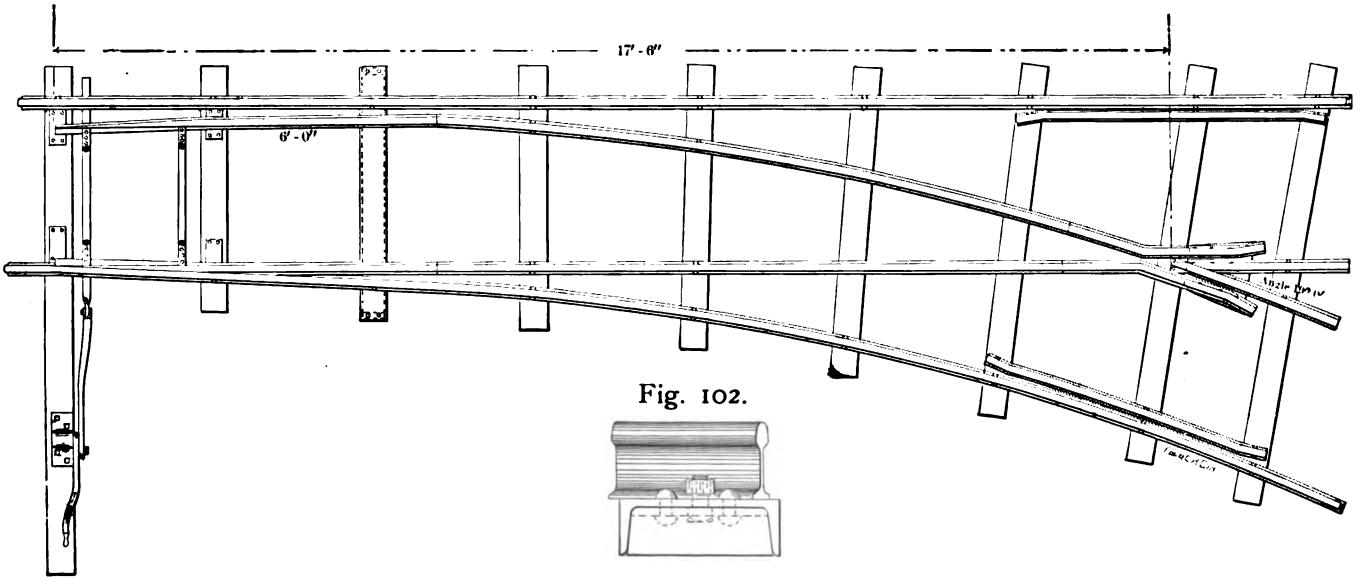


Fig. 102.

END VIEW OF STEEL TIE.

T-RAIL FROG FOR USE IN PAVED STREETS.

NO GUARD.

By Fig. 129 we show a T-rail Frog without guards, which especially suits Lateral Turnouts and Diamond Switches. We fill the heel and toe with cast blocks, and place wrought-iron strap-irons on the outside of the rails. These latter fit snugly between the head and base of the rail, and when the whole is bolted with six bolts it makes a very substantial Frog.

T-RAIL FROG FOR USE IN PAVED STREETS.

NO GUARD.

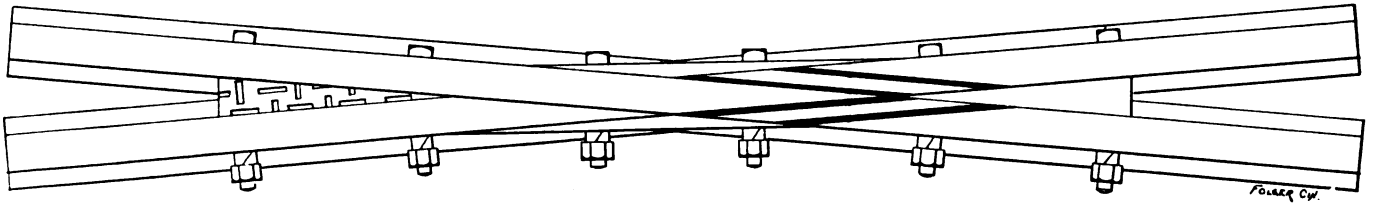
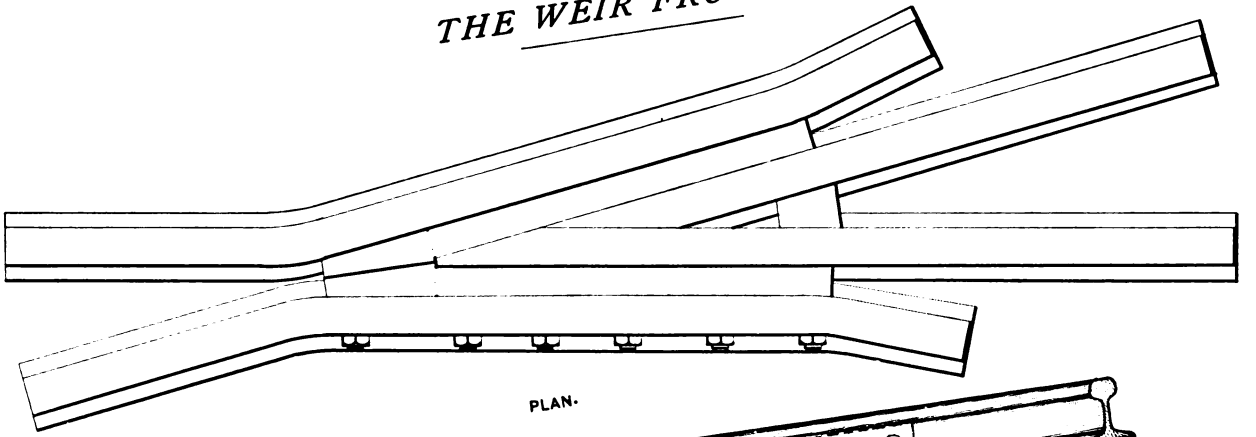


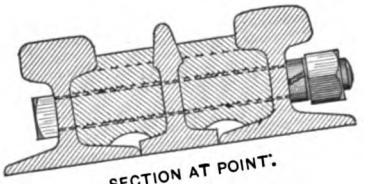
Fig. 129.

FROG WITH FILLED FLANGEWAY.

When a Frog is required for use of car-wheels having a narrow tread, such as used on surface roads, it is necessary to use a filling which fills up the flangeway so as to carry the wheel upon its flange from the point to the full head at the wing rail without allowing the wheel to drop down into the flangeway. The Frog shown by Fig. 77 fulfills these requirements very well, and should be used under these conditions. They can be made any angle or length.

THE WEIR FROG CO.





FROG WITH FILLED FLANGEWAY.

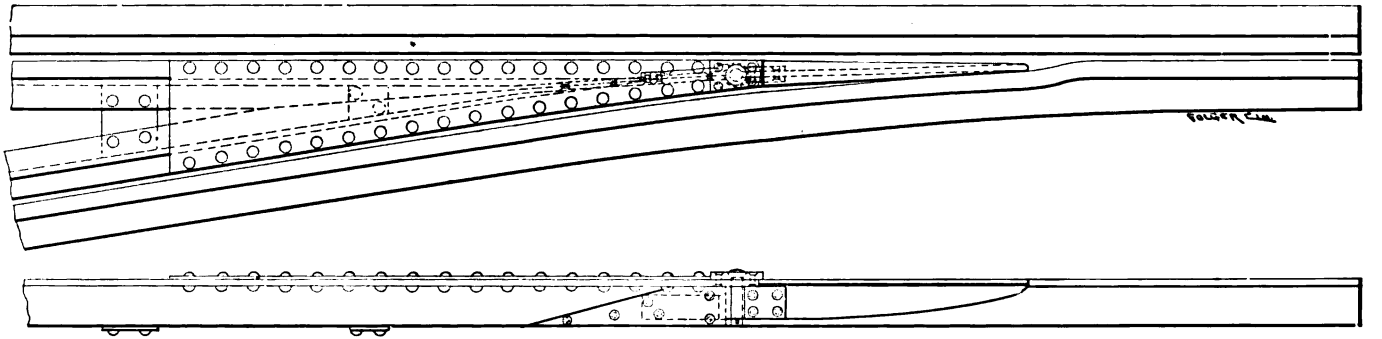
Fig. 77.

SLOT-RAIL SWITCH.

The Switch shown in plan and elevation by Fig. 81 is for the use of Cable Railways where two cable tracks turn into each other. This is especially designed for places where the cars from the turn-out track trail the point. Should it be necessary to run cars on the turn-out track facing the point, by taking off the spring the movable point can be thrown to either side.

SLOT-RAIL SWITCH.

Fig. 81.



PATENTED.

GIRDER-RAIL FROG.

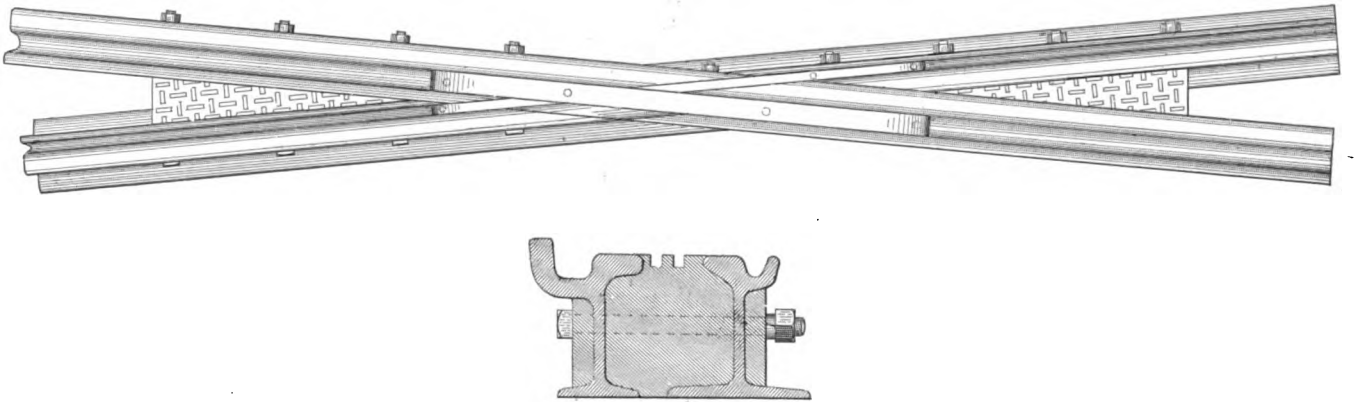
DESIGN NO. 2.

We have added this new design of Girder-Rail Frog, Fig. 103, of grooved rail and guard rail. The Frog is securely held together with ¾" bolts, heavy wrought-iron straps on the outside and cast-iron blocks in the heel and toe, which are flush with the head of the rails, and are toe-checked on top. This allows the use of paving-blocks in large pieces, and so the street does not require repairing as frequently. The flangeways are provided with steel risers, which carry the wheels on their flanges over the points of the Frog.

GIRDER-RAIL FROG.

DESIGN NO. 2.

Fig. 103.



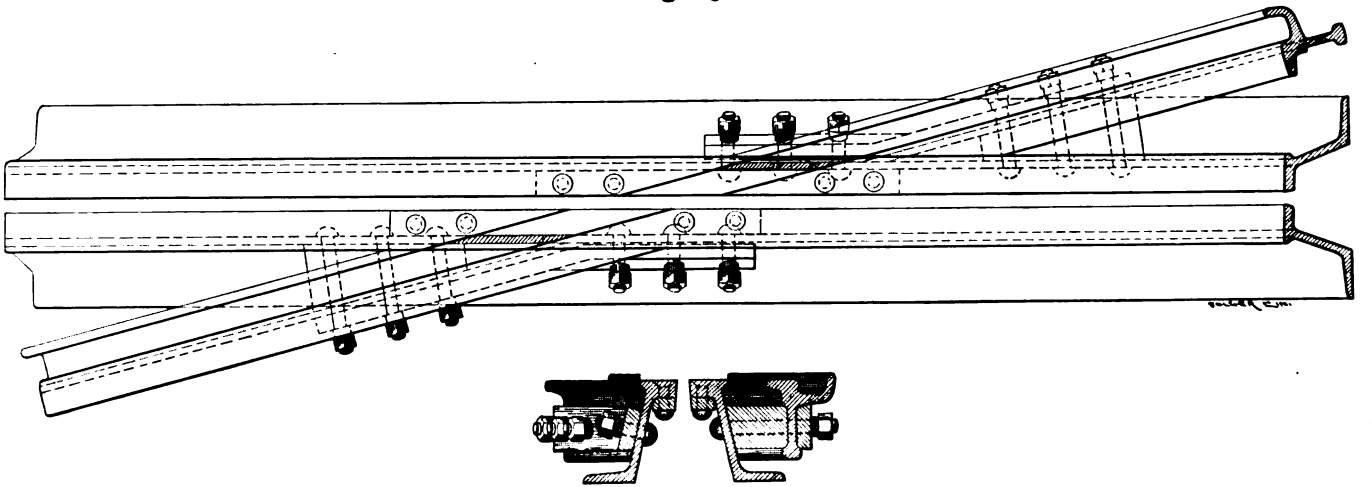
FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

SLOT-RAIL FROG.

This is for Cable-Railway Turnouts where the Tram Rail crosses the Slot Rail. We join the Girder Rails and Slot Rails by means of heavy wrought-iron straps and cast-iron blocks and bolts. A flangeway is planed through the head of the Slot Rail, and a piece of iron riveted on the under side of the head to form a guide for the grip-iron and to strengthen the Slot Rail.

SLOT-RAIL FROG.

Fig. 83.



PATENTED.

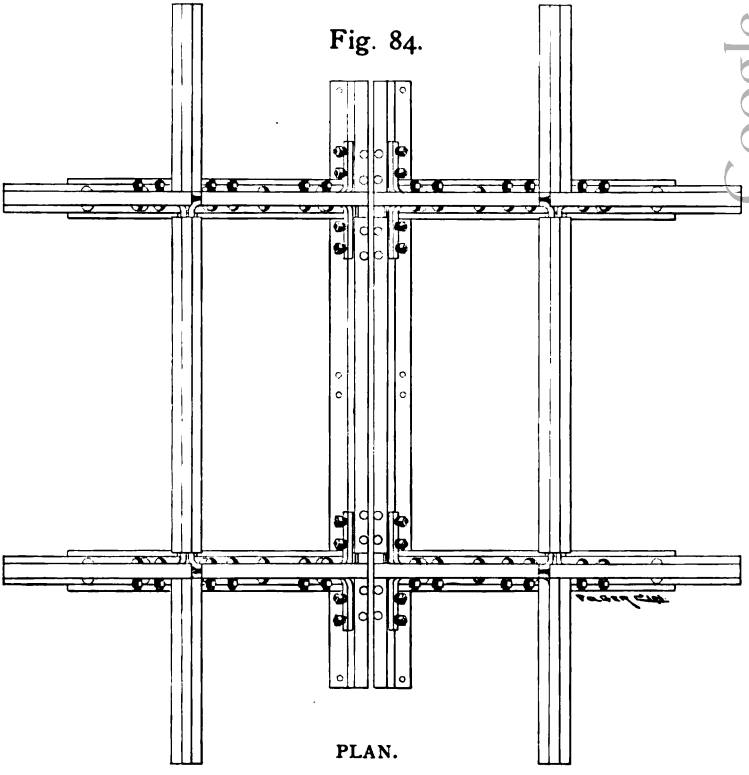
FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

CROSSING FOR STEAM ROADS AND CABLE ROADS.

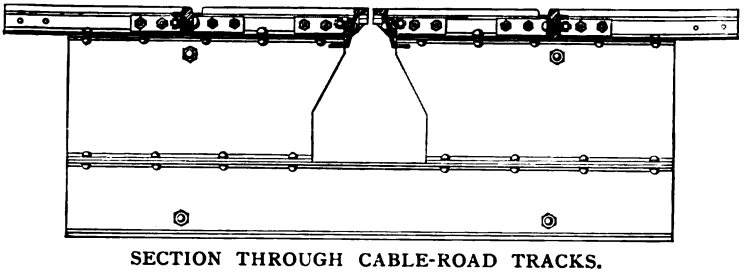
We claim to have the very best design of Cable- and Steam-Road Crossing yet produced, for the following reasons: Under each of the T rails for the steam roads are two deep I beams which are supported on bottom I beams crossing under the conduit and running the full length of the Crossing. This design prevents the closing of the slot due to creeping of the steam-road rails, because the rails are securely riveted to the top I beams, and the latter are riveted to the bottom I beams. The depth of this bottom beam is so great and the beam for that reason so rigid that it is impossible to close the slot by springing the beam. We have patented this substructure. When desired, guard rails will be used on the steam-road track, bolted to the running rail, and with rolled steel filling-blocks between. The girder and slot rails are held by heavy iron straps, bent to the angle and bolted to the rails. It will be noticed, also, that the head of the steam-road rail runs through the slot rail up to the edge of the slot. This gives the most efficient means of supporting the weight of locomotives and cars while crossing over the cable conduit. *We are the first to run the steam-road rail through the slot rail, and have a patent for this construction.* These Crossings can be made of any section of rails, and also of any angle or curve.

CROSSING FOR STEAM ROADS AND CABLE ROADS.

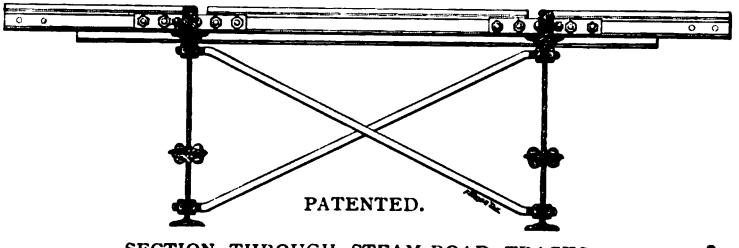
Fig. 84.



PLAN.



SECTION THROUGH CABLE-ROAD TRACKS.



PATENTED.

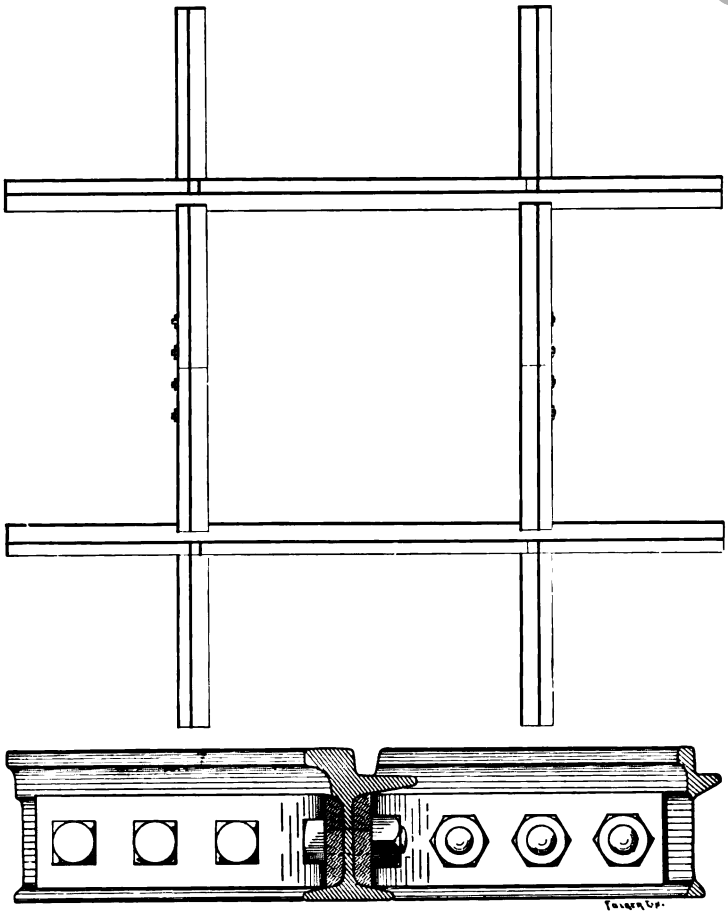
SECTION THROUGH STEAM-ROAD TRACKS.

STREET-RAILWAY CROSSING.

We illustrate here a light Crossing of Girder Rail, joined by heavy wrought-iron straps, and bolted together with forty-eight bolts. It is intended for electric or horse-car lines only, and for those who desire a smooth-running track with as little jar to the cars as possible. As with all other Crossings, we can make this one of any section of rail and any angle desired.

STREET-RAILWAY CROSSING.

Fig. 85.



SECTION SHOWING WROUGHT-IRON STRAPS AND BOLTS.

STREET-RAILWAY SPECIAL WORK.

We illustrate nineteen diagrams of special work to help the purchaser make clear his requirements.

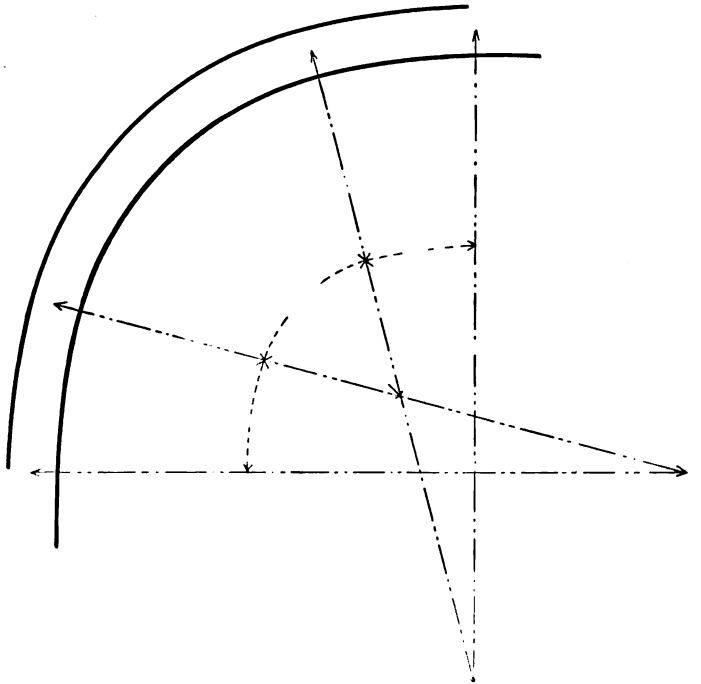
Please be kind enough to use the terms given for each plan of work shown, as it prevents confusion and misunderstandings.

It will be noticed that the curves are shown with easements at the ends; we consider this a great advantage, because it lessens the sudden jar on the cars when taking the curve, and it should always be used when the streets are wide enough to permit it. We can, and do, make curves on true circles when preferred.

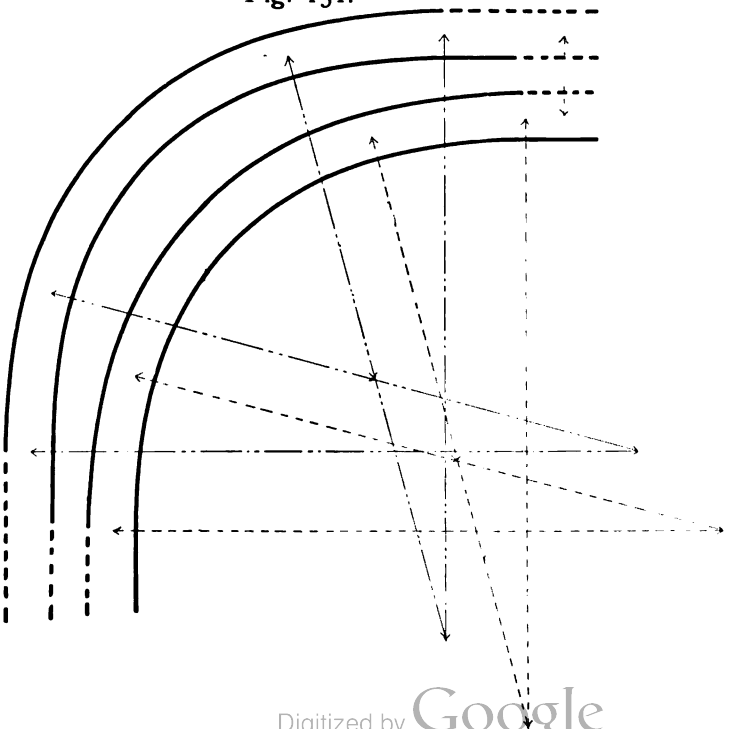
In double-track work we make the radius of each track the same. This throws the tracks farther apart in the middle of the curve than at the ends, thereby permitting cars to pass each other on the curves without danger to passengers or cars.

Please read instructions for ordering Street-Railway work, page 9.

SINGLE-TRACK PLAIN CURVE.
Fig. 130.



DOUBLE-TRACK PLAIN CURVE.
Fig. 131.



SINGLE-TRACK BRANCH-OFF CURVES.

Fig. 132.

LEFT-HAND.

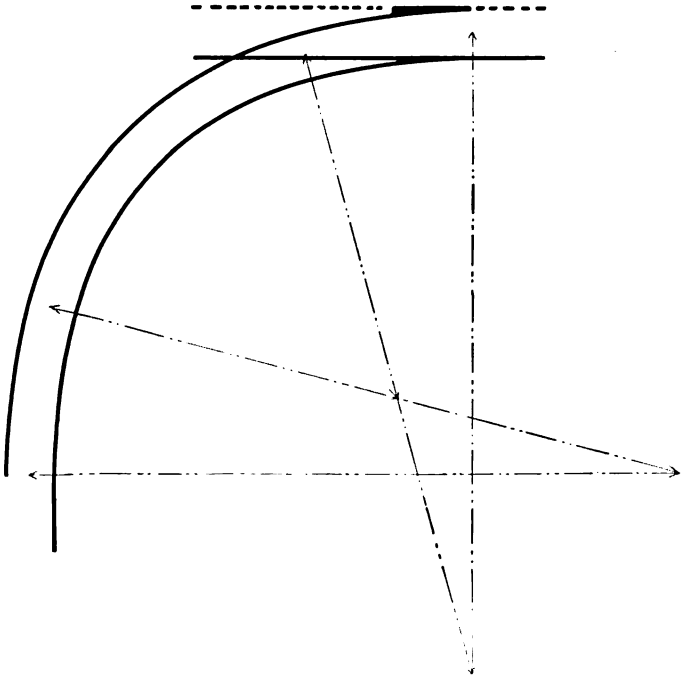
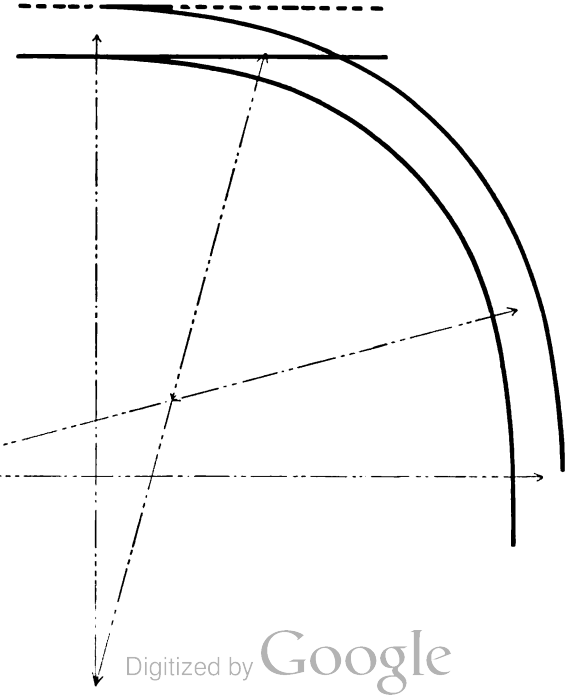


Fig. 133.

RIGHT-HAND.



DOUBLE-TRACK BRANCH-OFF CURVES.

Fig 134.
LEFT-HAND.

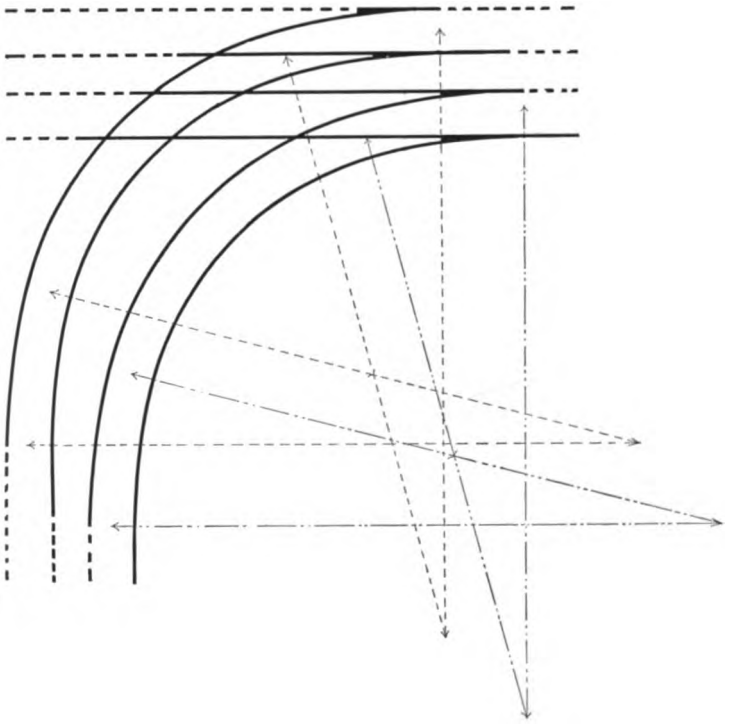
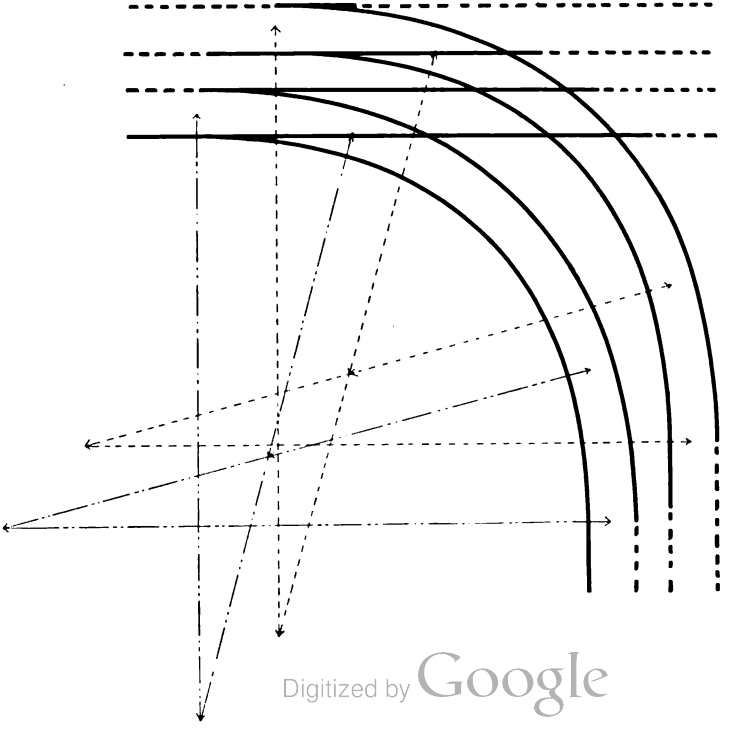
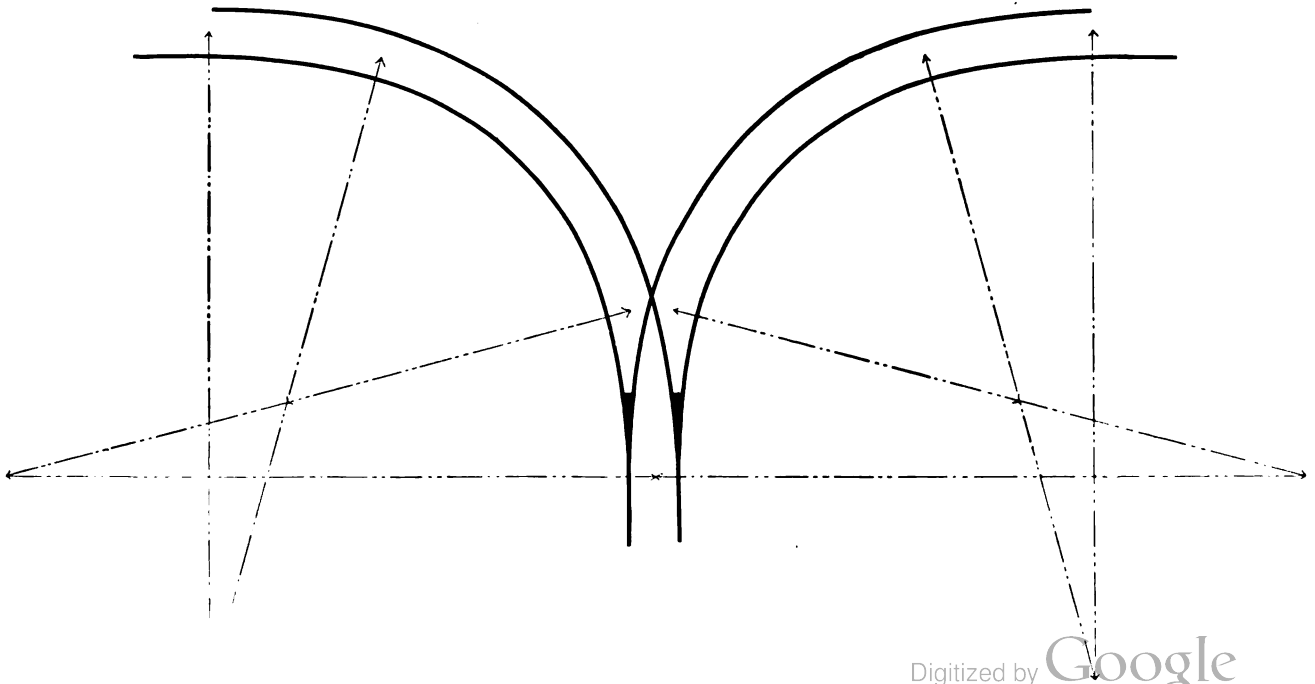


Fig. 135.
RIGHT-HAND.



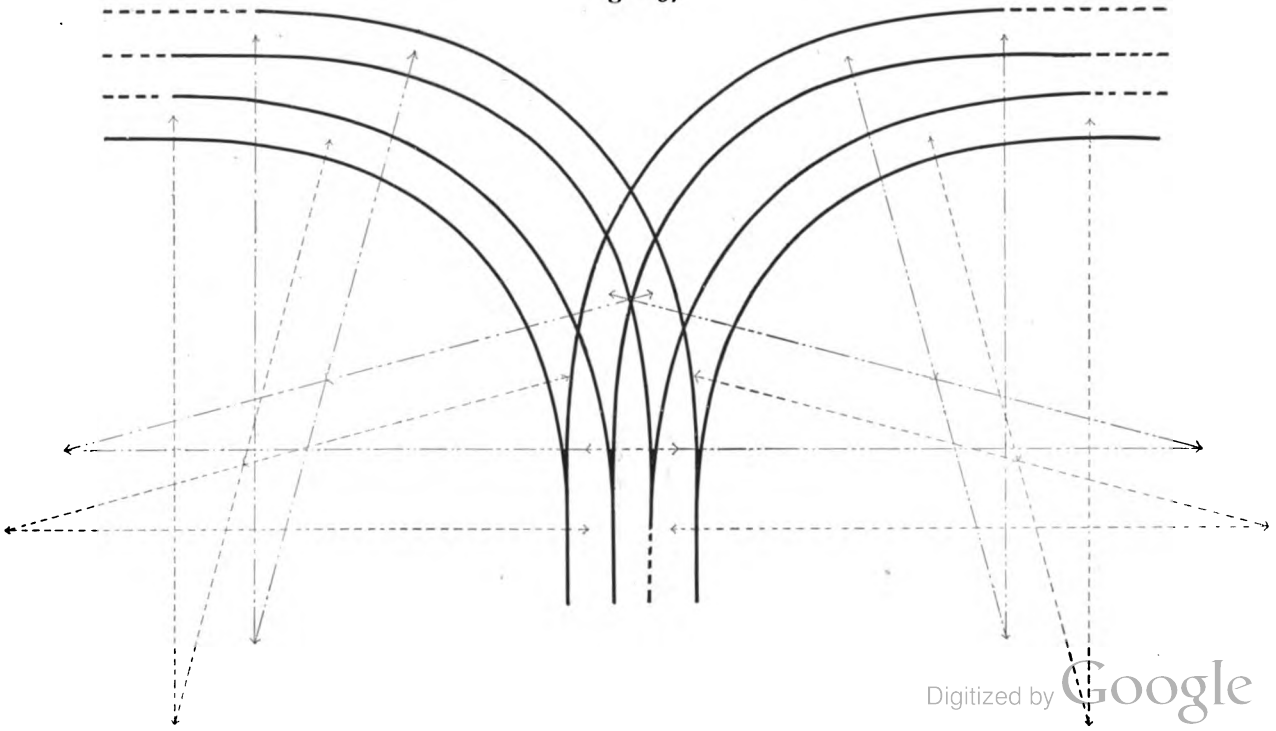
SINGLE-TRACK Y CURVE.

Fig. 136.



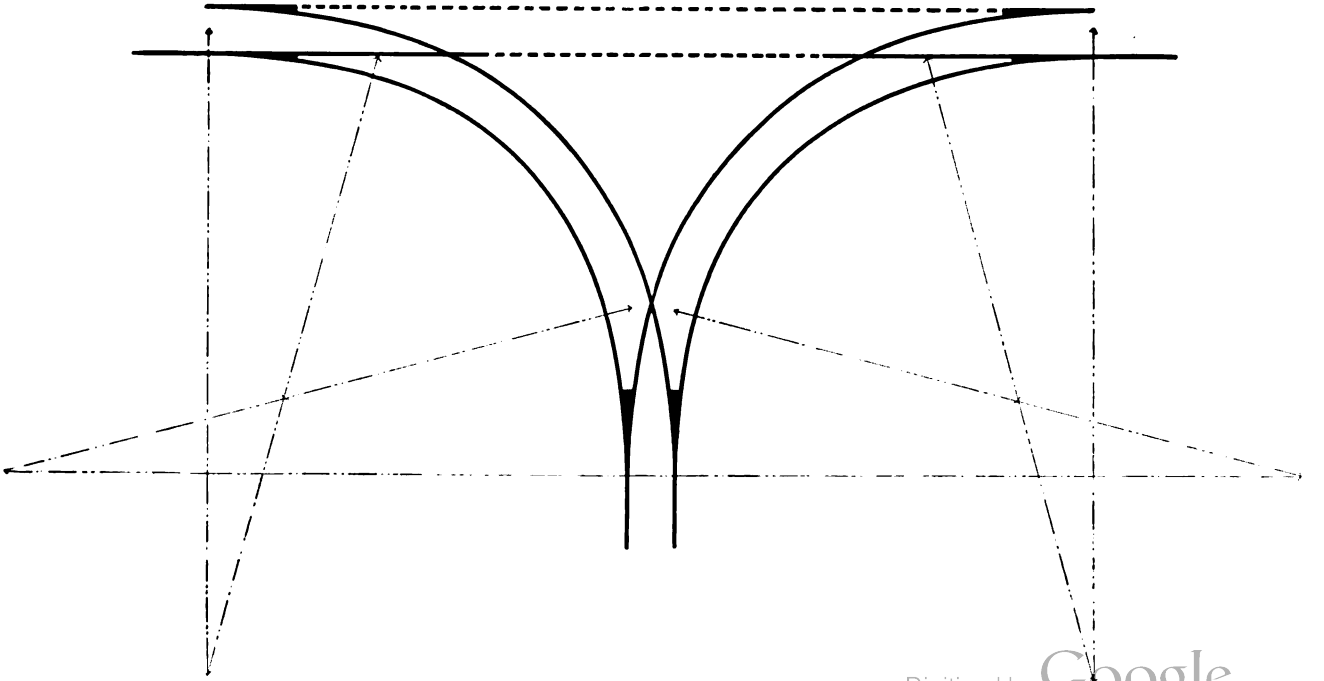
DOUBLE-TRACK Y CURVE.

Fig. 137.



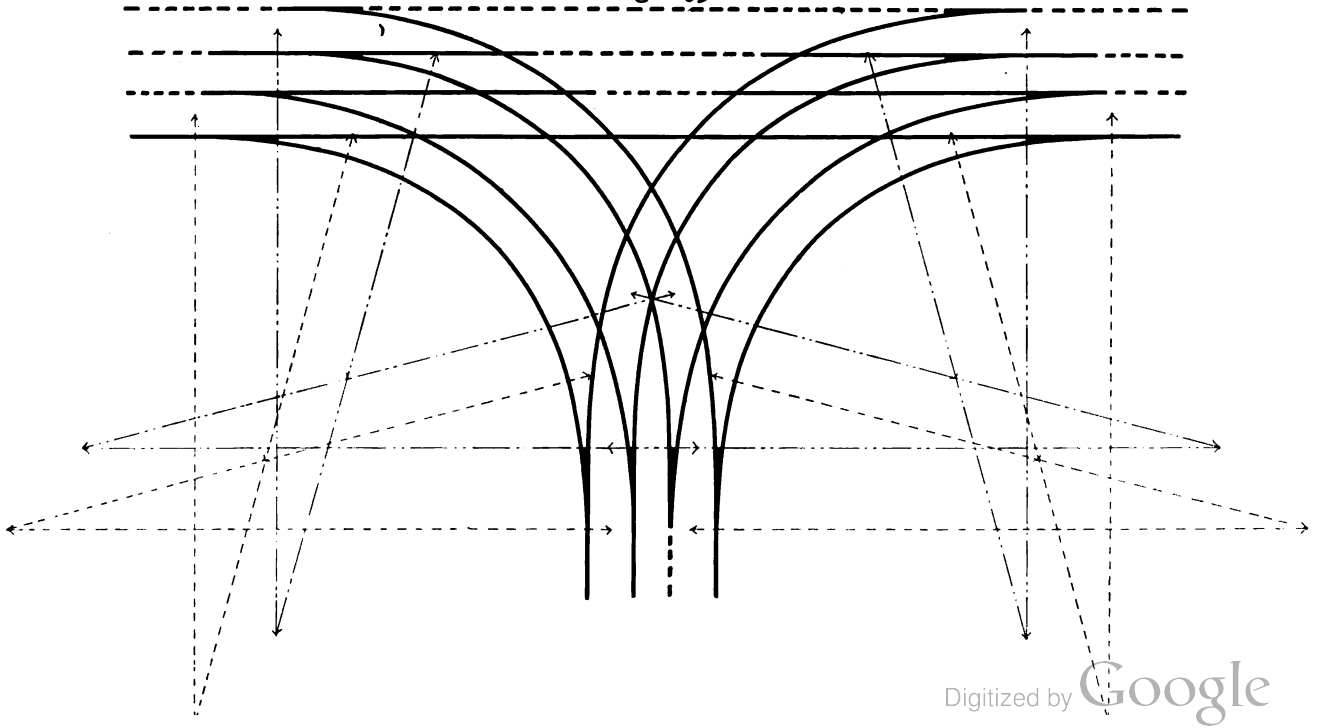
SINGLE-TRACK THREE-PART Y CURVE.

Fig. 138.



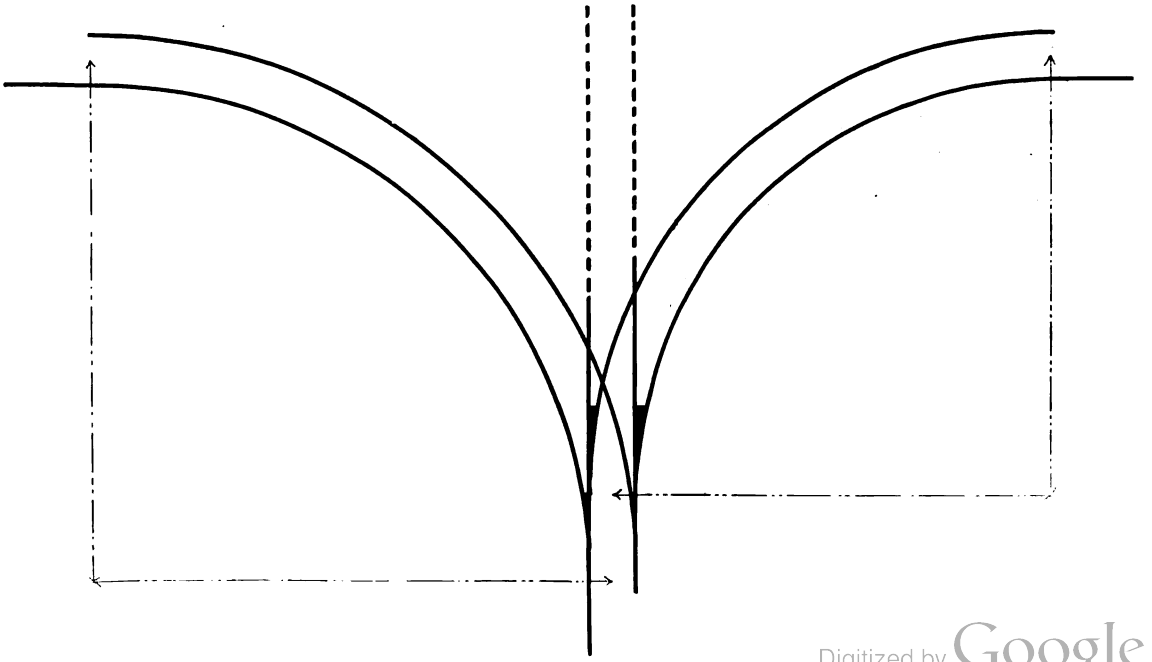
DOUBLE-TRACK THREE-PART Y CURVES.

Fig. 139.



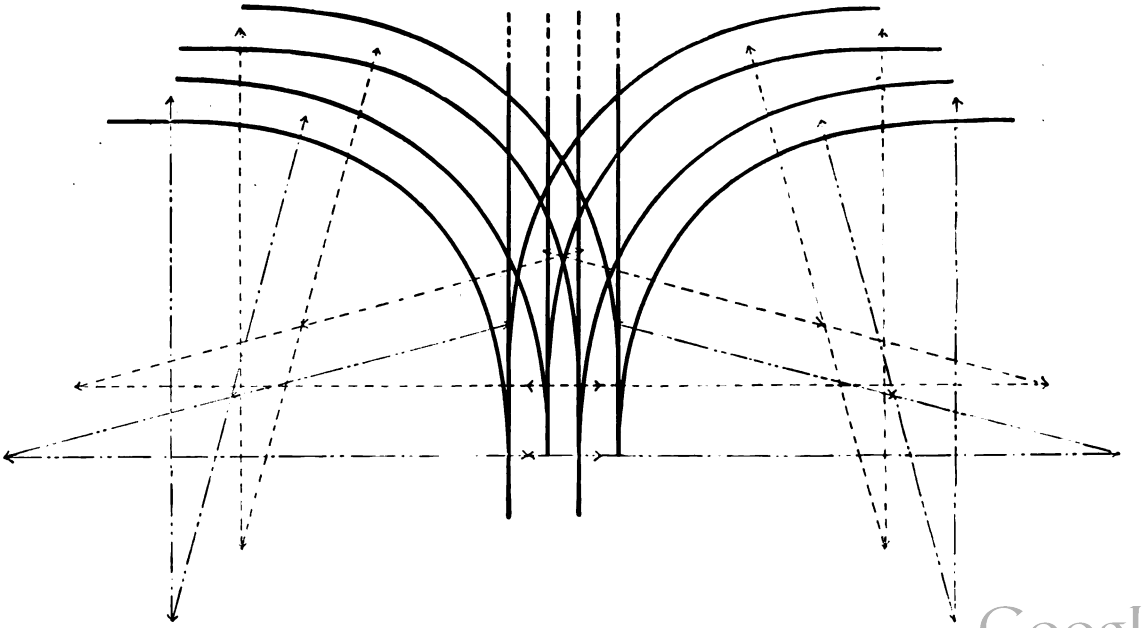
SINGLE-TRACK THROUGH Y CURVES.

Fig. 140.



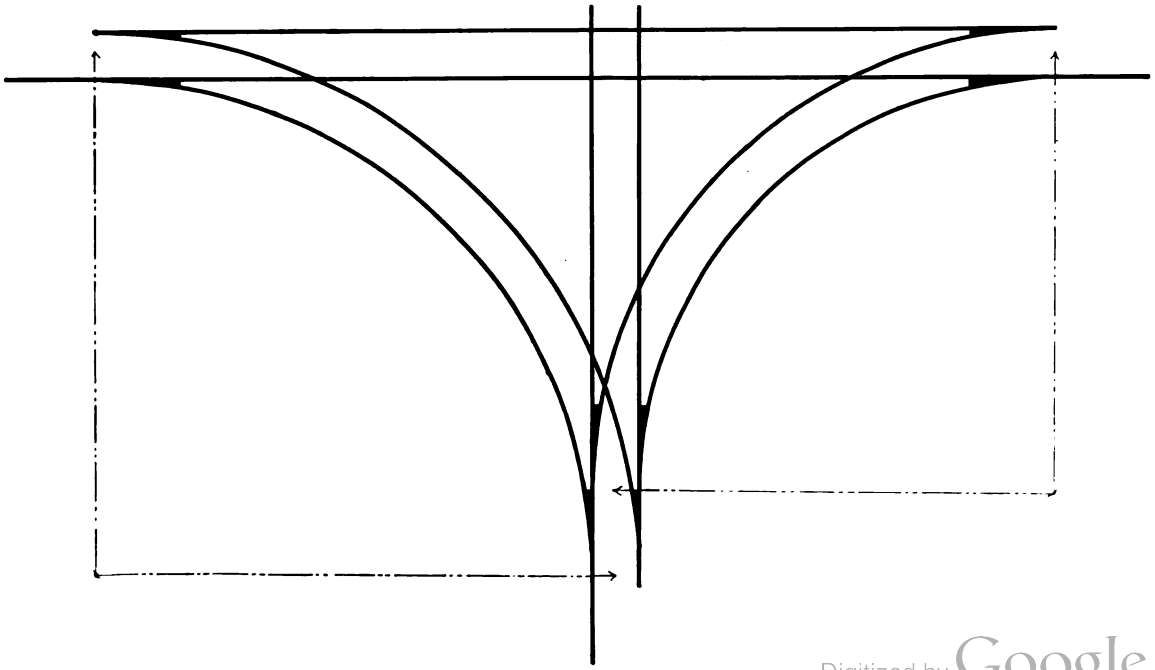
DOUBLE-TRACK THROUGH Y CURVES.

Fig. 141.



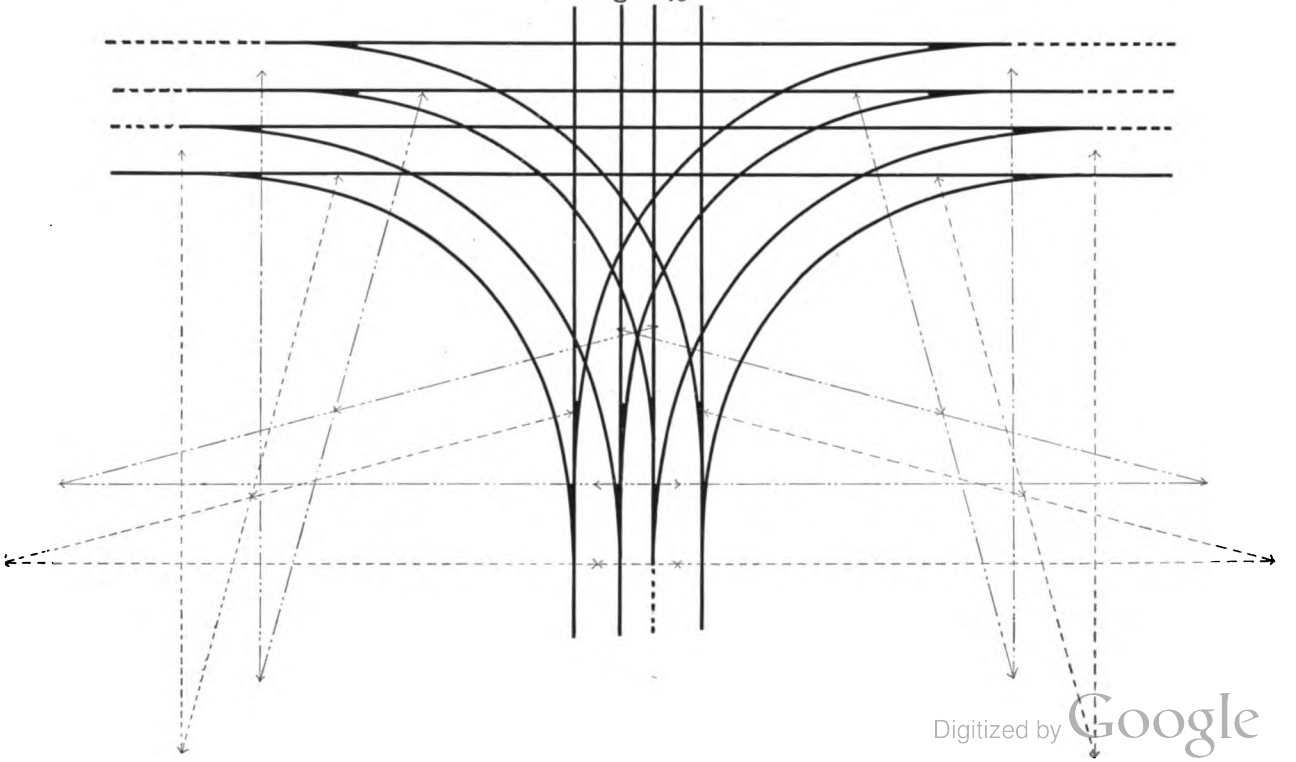
SINGLE-TRACK THROUGH Y CURVES WITH CROSSING.

Fig. 142.



DOUBLE-TRACK THREE-PART Y CURVES WITH CROSSINGS.

Fig. 143.



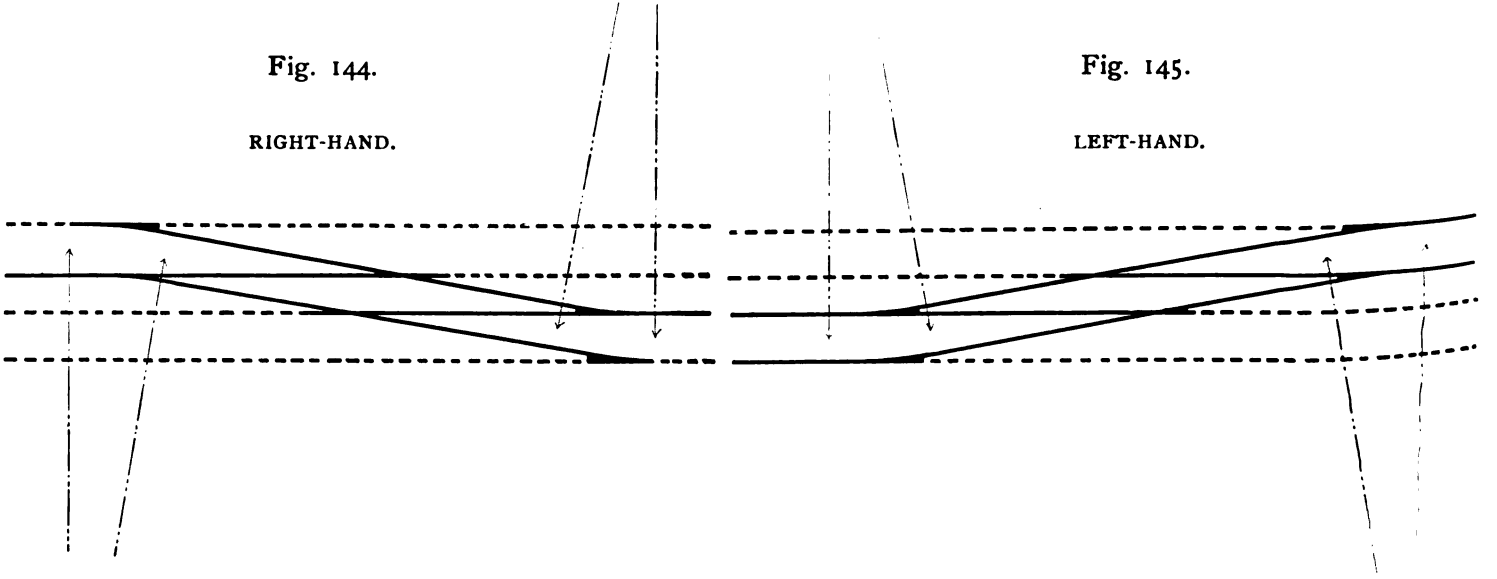
STANDARD CROSSOVERS.

Fig. 144.

RIGHT-HAND.

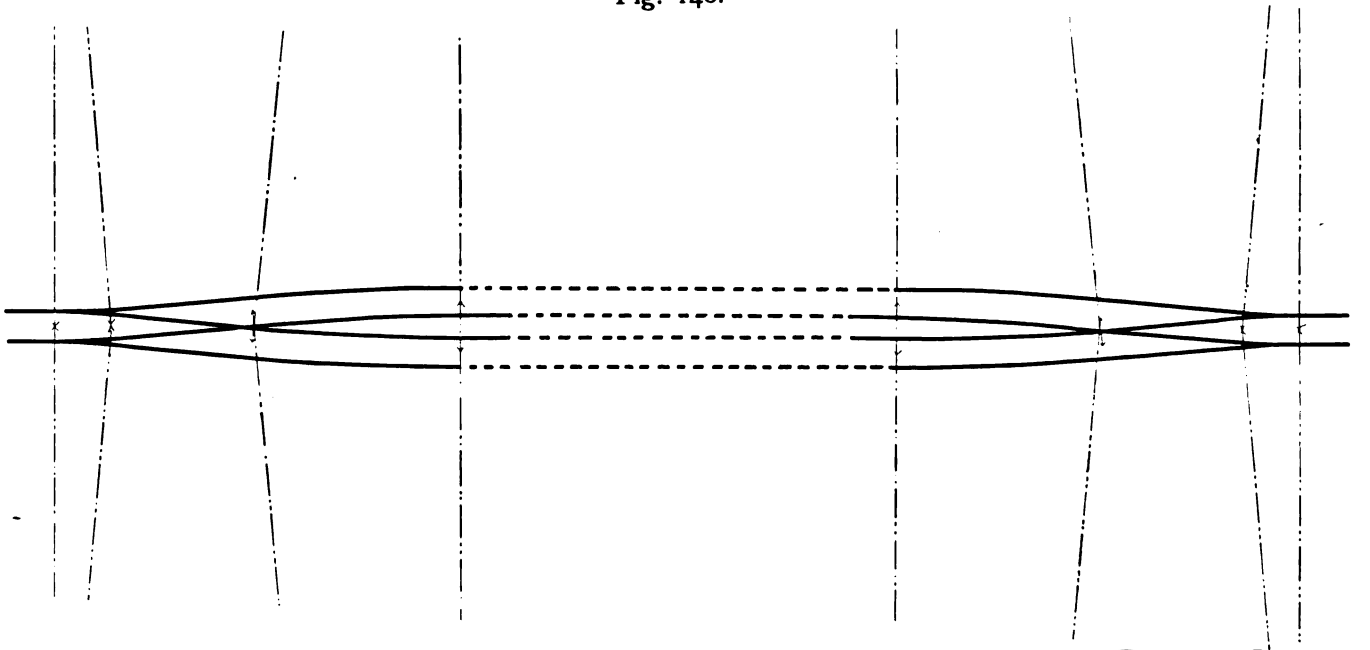
Fig. 145.

LEFT-HAND.



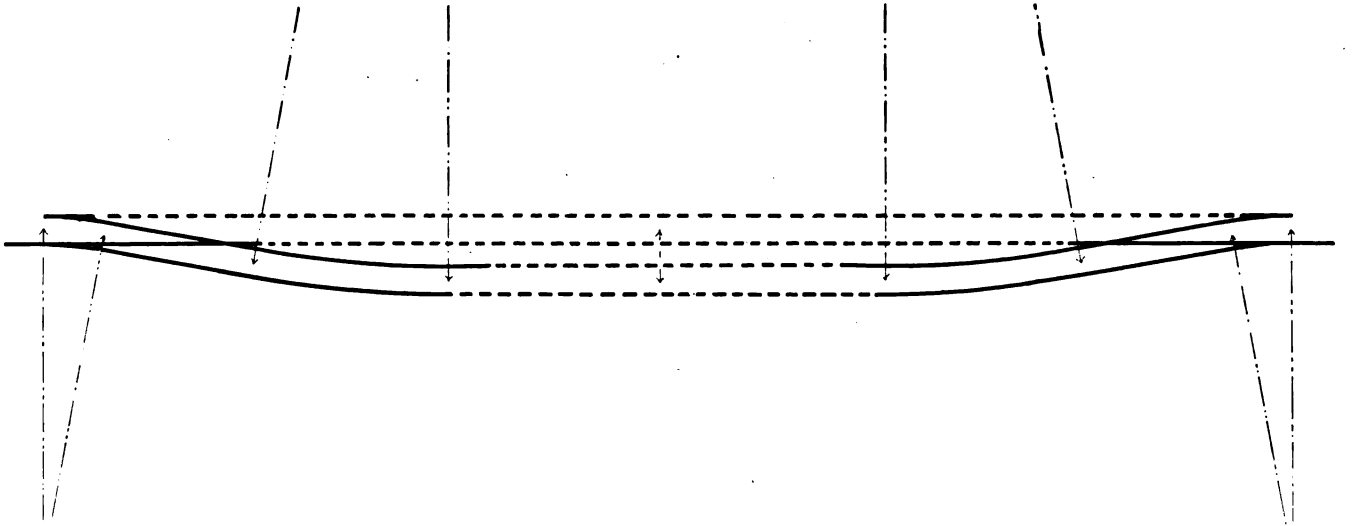
STANDARD DIAMOND SWITCH.

Fig. 146.



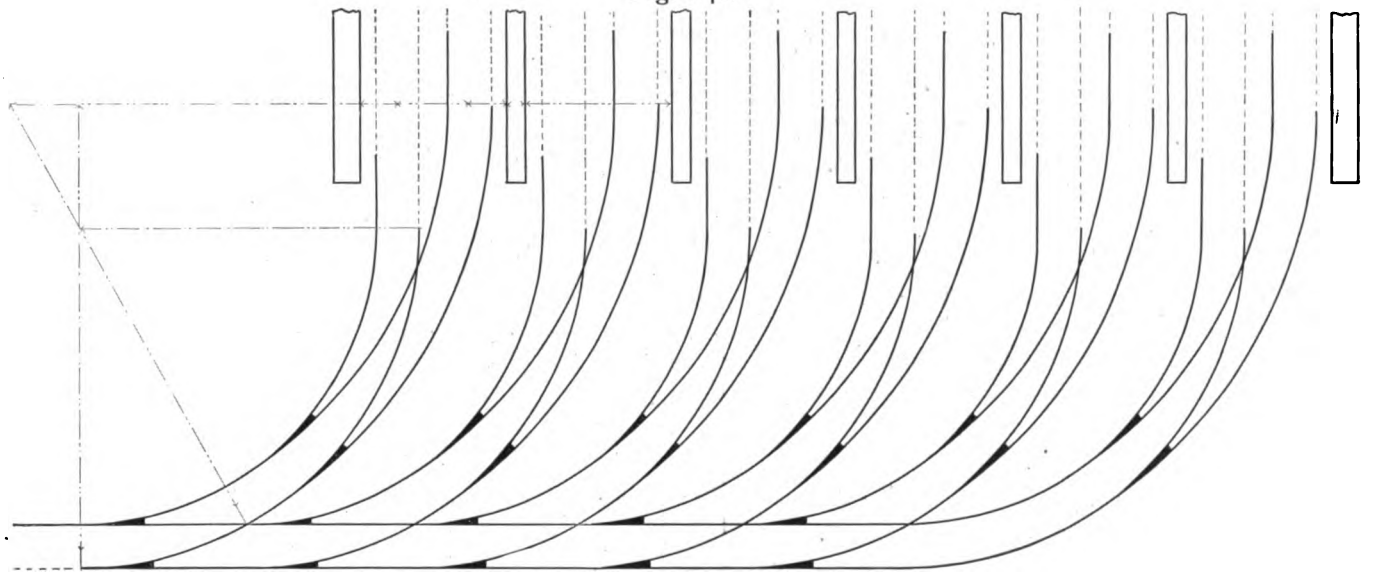
STANDARD LATERAL SWITCH.

Fig. 147.



CAR-BARN CURVES.

Fig. 148.



FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

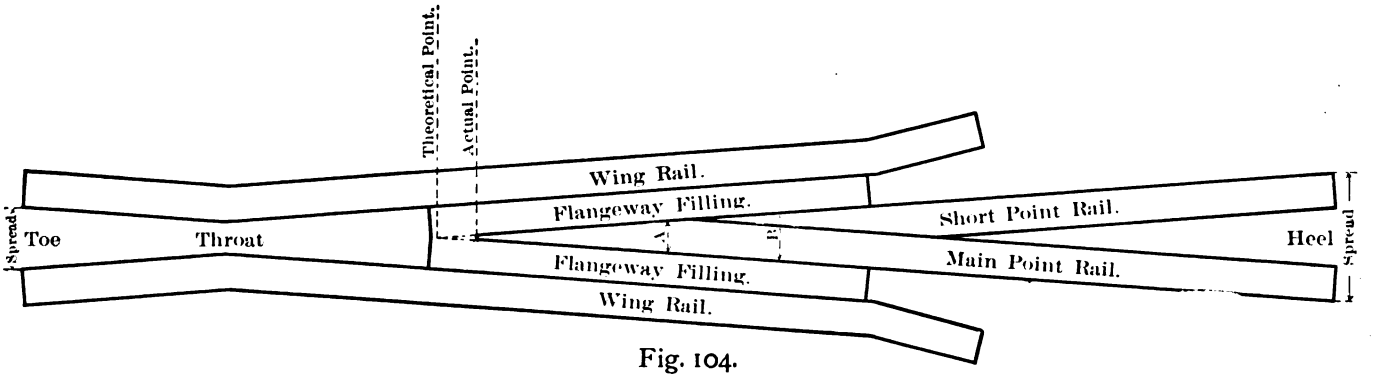


Fig. 104.

SIMPLE RULES FOR LAYING TURNOUTS, ETC.

DEDUCED FROM W. H. SEARLES', C. E., "FIELD ENGINEERING."

To find the number of a Frog: The number of Frog is same as the number of feet in which it spreads one foot, or the number of inches in which it spreads one inch. For instance, a No. 10 Frog spreads one inch in ten inches of length, or a No. 6½ Frog spreads one inch in six and one half inches of length. Then, to find

the number of a Frog, place a rule on the head of the point-rails where the point is two inches wide from gauge side to gauge side, mark that place as at A, Fig. 104, then move the rule back towards the heel of the Frog until the head measures three inches wide, and mark this place as at B, Fig. 104. The distance in inches between the two marks is the number of the Frog. As a check upon this, measure the spread of the Frog at heel, which is the distance from gauge side to gauge side of the head of the rails. Having previously found and marked the place where the point is two inches wide, measure from that mark the distance to the heel of the Frog, and divide that distance in inches by the spread less two inches. The result is the Frog number. In practice, the result may not come an exact even number, but the nearest whole number is probably the correct Frog number. This variation is partially due to slight errors in measuring, or to the fact that the Frog is not the exact angle, which is frequently the case with old Frogs. It will be noticed that the number of the Frog varies inversely as the angle expressed in degrees and minutes. For instance, a No. 8 Frog has a larger angle in degrees and minutes than a No. 10 Frog. EXAMPLE: The spread of a Frog whose angle or number is not known is found to be 8⅝″. The distance from the place where the head of the points measure two inches to the heel of the Frog is 4′ 11⅝″, which equals 59⅝″. The spread, 8⅝″, minus 2″, is 6⅝″, and 59⅝″ divided by 6⅝″ equals 9, which is the Frog number.

To find the lead of a Turnout: The lead is the distance from the point of the Frog to the point of the Switch, and in the case of Turnouts from a straight track is equal to the gauge of the track multiplied by twice the number of the Frog. EXAMPLE: Suppose we want to know the lead of a Switch using a No. 9 Frog, and the

gauge of the track is 4′ 8½″, or 4.708 feet. We multiply 4.708 by twice 9, or by 18, and we have as a result 84.744 feet, or 84′ 9″. The leads given by this rule are theoretical leads, and are somewhat longer than those used in practice by some roads. See pages 213 and 214.

To find the radius of a Turnout: Multiply twice the gauge of the track in feet by the square of the Frog number. EXAMPLE: What is the radius of a No. 10 Turnout, gauge 4′ 8½″, or 4.708 feet? Ten squared is 100, multiplied by twice 4.708 feet equals 941.6 feet, which is the radius of a six-degree five-minute curve.

A simpler way of finding the radius is to multiply the lead by the number of the Frog. EXAMPLE: For a No. 9 Frog, radius of the Turnout equals 84.744 feet (the lead) multiplied by 9, which equals 762.696 feet. The rules for obtaining the radii of Turnouts are exact in all cases, provided the theoretical lead is always used in the second method.

In the case of *Double* or *Three-Throw Turnouts* the distance from the point of the Crotch Frog to the point of the Switch is equal to the radius of the Turnout track divided by twice the number of the Crotch Frog. This radius can be found by a previous rule when the number of the main-line Frog is known, and also the gauge of the track; and the number of the Crotch Frog is approximately seven-tenths the number of the main-line Frog. EXAMPLE: Suppose a double Turnout using No. 10 Frogs on the main-line tracks. The lead of the main-line Frogs is 2 x 10 x 4.708=94.16 feet, and the radius of the Turnout track equals 94.16 x 10=941.6 feet. The number of the Crotch Frog is 7 (being $\frac{7}{10}$ of the main-line Frog number). Divide 941.6 feet by twice the Crotch Frog number, or 14, and we have 67.25 feet as the distance required. The rule is approximate only; the exact

theoretical lead for the No. 7 Crotch Frog being 66.62 feet. This variation is due to the fact that the Crotch Frog number is not exactly seven-tenths the number of the main-line Frog.

For *Stub-Rail Switches* the length of the Switch or moving rail, which should be left unspiked, is equal to the square root of twice the radius multiplied by the throw of the Switch in feet. EXAMPLE: Required the length of the moving rail for Stub Switch with a No. 6 Frog, and having a five-inch throw. The lead of a No. 6 Frog equals 56.496 feet, therefore the radius of the Turnout equals 338.976 feet. Twice the throw equals 10″, or .833 foot, multiplied by 338.976 equals 282.367 feet, and extracting the square root of this we have 16.8 feet, the length of switch rail. This rule will give in all cases the theoretical length of switch rail, which is often too long for practice, but by means of it the position of the head-chairs or switch-block may be determined by taking the theoretical length of switch rail from the theoretical lead; the result is the distance from the point of the Frog to the head-block. See Tables No. 1 and No. 4.

When the *main track is curved* and the *Turnout* is to be placed on the *inside* of the *curve*, the lead is in most cases so nearly the same as that from a straight track that for all practical purposes the rule for those leads may be used, but when the *main track is curved* and the *Turnout* is on the *outside* of the curve, we may have one of three conditions: first, the Turnout may curve in the same direction as the main line; secondly, it may be straight; and, thirdly, it may curve in the opposite direction from the main line. This all depends upon the number of the Frog to be used. For if we imagine for the moment the main line to be the Turnout, and the true Turnout to be straight and to be the main line, then we have merely the problem to find the number of the Frog

for a Turnout from a straight track when the radius of the turnout is known, which radius in this case is that of the main track, of course. Now the number of the Frog is obtained in this way: divide the radius by twice the gauge and extract the square root of the quotient. The result is the number of the Frog. EXAMPLE: Suppose we have a main track on a six-degree five-minute curve, the radius of the curve equals 941.6 feet, the gauge of the track equals 4′ 8½″, or 4.708 feet. Twice that is 9.416 feet. The radius divided by twice the gauge, or 9.416, equals 100, and the square root of 100 is 10, which is the number of the Frog. Or, in other words, if we have a main line on a six-degree five-minute curve, a Turnout from that track and running perfectly straight will require a No. 10 Frog. Now it is clear that a Frog of a higher number than a 10, such as a No. 11 or No. 12, will be required if the Turnout curves in the same direction as the main line, and at the same time is on the outside of the main line; but a Frog of a lower number will be required if the Turnout curves in the opposite direction.

As we stated before, the lead is in most cases so nearly that of Turnouts from a straight track that for all practical purposes those leads may be used for curved as well as straight tracks. If we have the case of a straight main track and a double Turnout, both of them on the same side of the main line, we will have both the Crotch Frog and one of the end Frogs in the main-line track, and the other end Frog in the first and second Turnout tracks. If we suppose the two end Frogs that are the two farthest from the Switch to be opposite each other and the same angle, we can calculate the lead of the main-line Frog (which is the lead of the other one as well), and then the radius of the first Turnout curve; from that radius and the angle of the Frog we can find the radius of the second Turnout curve. The number of Crotch Frog is, as we know, approximately seven-tenths that of

the main-line Frog, so, with the number and the gauge known, we can readily calculate the lead of the Crotch Frog.

If we have a crossover to put in, and the tracks are straight and parallel, the only new question is to find the distance between the two Frogs. This is obtained by the following rule, which is mathematically correct: Divide the gauge (in feet) by the cosine of the Frog angle; add the gauge to the quotient, and subtract this sum from the distance (in feet) being track centers; then divide the remainder by the tangent of the Frog angle. The result is the distance in feet from the theoretical frog-point of one Frog to that of the other, measured along the rail of either main-line track. See table, page 216. Or this can be done by this rule, which is only approximate, but may be near enough for practical work: Subtract twice the gauge from the distances between track centers, and multiply this by the number of the Frog. The result is the distance between the points of the first Frog and the second Frog, measured along one of the main-line tracks.

EXPLANATION OF TABLES.

TABLE No. 1 is a table of theoretical leads, *i*, *e*., for Turnouts on true circular arcs. This is very seldom done in practice, but the leads are correct for Turnouts in which stub switches are used. The theoretical stub switch length is too long for a No. 12 Frog, and too short for a No. 4 Frog. These can be changed in track to suit the case. Frog distance "L" is given to the theoretical point of the Frog, while the "Distance from Head-Block to Frog-Point" is to actual point of Frog.

TABLE No. 2.—This table is for Turnouts as they are usually laid in practice. The switch-points are straight and the curve is tangent to the switch-angle, the leads are shorter than theoretical leads, and very near those in common use. *We recommend the use of this table to practical trackmen.*

TABLE No. 3.—When spring frogs are used, and when both switch-points and frogs are straight, the leads are somewhat different than those for fixed frogs, because the spring frogs are so much longer. But they are just as they should be in this table to give good line.

TABLE No. 4.—This table, in connection with No. 1, gives all dimensions required for a Three-Throw Stub Switch Turnout.

TABLE No. 5.—For Single or Double Cross-Overs we give a table of distances between actual points of Frogs from No. 6 to No. 12, and with track centers varying by six inches (6″) from 11½ feet to 15 feet. Using this table in connection with table No. 2 will give the total length of a Cross-Over from switch-point to switch-point.

TABLE No. 6.—We give here a Bill of Ties for Single Turnouts with leads as given in our Table No. 2, and from No. 6 to No. 10 Frogs. These ties are to be laid in the order given in this table, and will be all the special timbers required; all other ties are standard length. The Frog and Stand-Ties are given a little wider than the others, but this is not absolutely necessary, although it is advisable

TABLES No. 7, 8, 9, 10, and 11 are Bills of Ties for Cross-Overs from No. 6 to No. 10 Frogs, and with four distances between track centers. The number of each tie is the total number required of that size for the complete Cross-Over, and for this reason they should be laid half and half at each end of the Cross-Over. These are figured to suit Cross-Overs Laid by Tables No. 2 and 5, and with ties at right angles to main track.

TABLE No. 12 is a Bill of Ties for Combination Crossings, Design No. 2, from No. 6 to No. 9. They are figured, lying at right angles to a medial line through the Crossing, and the number of ties given is all that is required for one complete combination. In lay-

ing the ties, begin at the center of the Crossing, and place half of each number to the right, and the other half to the left, selecting the lengths in the order given in this table, thus working towards the end frogs. We have specified 7″ x 10″, spaced about 22″ center to center, because we think combinations can not have too good a foundation under them. Of course smaller end sizes can be used.

The ties marked with an asterisk are those to which the switch-stand, the T-crank stands, and the pipe-carriers are spiked (see Fig. 29), and for this reason they must extend out beyond the line of the other ties, on the side upon which the Stand is to be placed.

TABLE No. 13.—This table wili be of use to contractors and others, to get the total number of feet (board measure) in a lot of special Ties, and upon which to base an estimate of their cost. We understand standard track ties are generally bought by railroad companies by the piece, but timbers for Turnouts and Cross-Overs are estimated by the foot (B. M.).

TABLE No. 14.—Here we give the number of Ties required per mile of track with different spacing, and also the total feet (B. M.) for several sizes of Ties. This may be of use to contractors in their estimates.

TABLE No. 15 consists of gross tons per mile of track for different weights of rail, and the number of angle bars per ton of rail of various weights and lengths. These are especially for estimating cost of new track, and will be of use to contractors and others.

TABLE No. 16 consists of number of angle bars and bolts per mile of track for different lengths of rails, also all the number of spikes of different sizes per mile. Like Tables No. 13 and 15, this will be of use to contractors more especially.

TABLE No. 17.—This is the only Table of Middle Ordinates *given in inches* for curving rails of different lengths. These ordinates have always been given in decimals of a foot, which render them of little use to the average man who carries a two-foot rule.

TABLE No. 18.—Table of common fractions of an inch converted to decimals of a foot. This is useful to engineers and calculators.

TABLE No. 19.—Is a table of common fractions converted to decimals, of great convenience to those who have much calculating to do.

TABLE No. 20.—Twenty-six different sections of T Rails are carried in stock by The Weir Frog Co. for the manufacture of track work, and any other special sections can be gotten if the mill and section number of rail is given. These given in the table we have at all times, and can furnish work of these sections promptly.

TABLE OF TURNOUTS FOR STUB SWITCHES. GAUGE 4′ 8½″. 5″ THROW.

(THEORETICAL LEADS.)

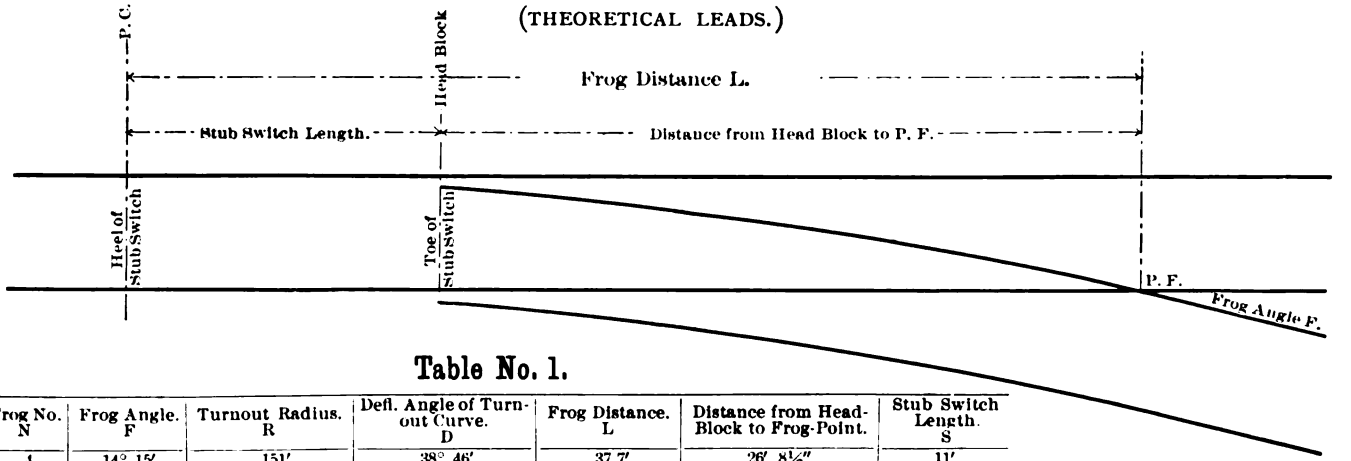


Table No. 1.

Frog No. N	Frog Angle. F	Turnout Radius. R	Defl. Angle of Turnout Curve. D	Frog Distance. L	Distance from Head-Block to Frog-Point.	Stub Switch Length. S
4	14° 15′	151′	38° 46′	37.7′	26′ 8½″	11′
4½	12° 41′	191′	30° 24′	42.4′	29′ 5 ″	13′
5	11° 25′	235′	24° 32′	47.1′	33′ 1¼″	14′
5½	10° 23′	285′	20° 13′	51.8′	36′ 9½″	15′
6	9° 32′	339′	16° 58′	56.5′	39′ 6 ″	17′
6½	8° 48′	398′	14° 26′	61.2′	43′ 2½″	18′
7	8° 10′	461′	12° 27′	65.9′	45′ 11 ″	20′
7½	7° 38′	530′	10° 50′	70.6′	49′ 7¼″	21′
8	7° 09′	603′	9° 31′	75.3′	53′ 3½″	22′
9	6° 22′	763′	7° 31′	84.7′	59′ 8½″	25′
10	5° 44′	942′	6° 05′	94.2′	66′ 2½″	28′
11	5° 12′	1139′	5° 02′	103.6′	72′ 7¼″	31′
12	4° 46′	1356′	4° 14′	113. ′	79′	34′

Approximately 6½ × N

TABLE OF TURNOUTS FOR SPLIT SWITCHES AND FIXED FROGS. GAUGE 4′ 8½″.

(CURVE TANGENT TO SWITCH ANGLE AT HEEL OF SWITCH.)

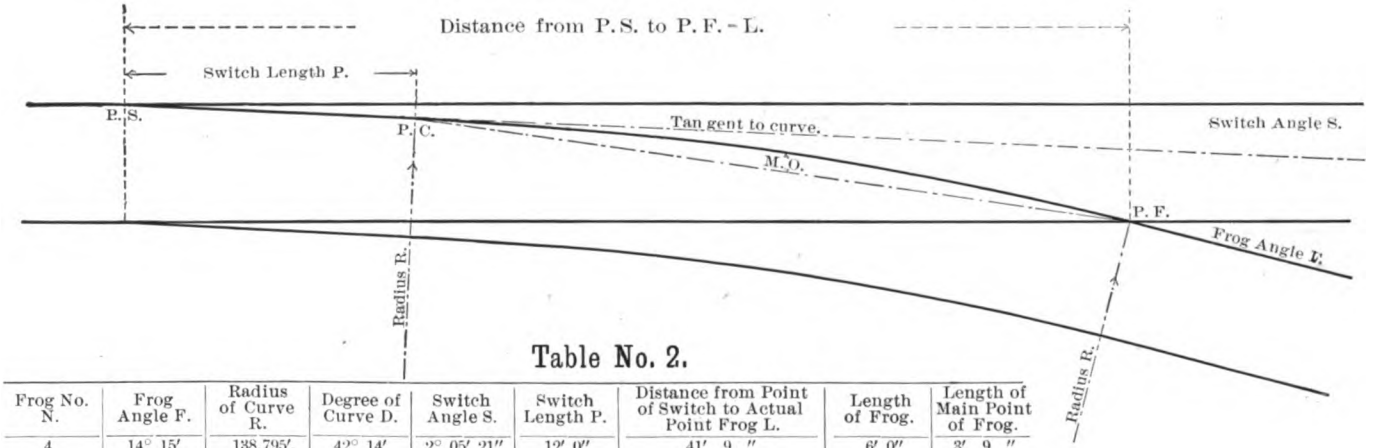


Table No. 2.

Frog No. N.	Frog Angle F.	Radius of Curve R.	Degree of Curve D.	Switch Angle S.	Switch Length P.	Distance from Point of Switch to Actual Point Frog L.	Length of Frog.	Length of Main Point of Frog.
4	14° 15′	138.795′	42° 14′	2° 05′ 21″	12′ 0″	41′ 9 ″	6′ 0″	3′ 9 ″
4½	12° 41′	176.665′	32° 53′	“	“	44′ 11¼″	6′ 0″	3′ 9 ″
5	11° 25′	217.132′	26° 38′	1° 40′ 16″	15′ 0″	52′ 2¾″	6′ 0″	3′ 10 ″
5½	10° 23′	264.421′	21° 48′	“	“	55′ 6 ″	6′ 6″	3′ 10½″
6	9° 32′	315.105′	18° 15′	“	“	58′ 6½″	6′ 8″	4′ 3 ″
6½	8° 48′	382.794′	15° 1′	“	“	62′ 10 ″	7′ 0″	4′ 6 ″
7	8° 10′	434.889′	13° 14′	“	“	64′ 7½″	7′ 0″	4′ 6½″
7½	7° 38′	501.200′	11° 26′	“	“	67′ 5¾″	7′ 6″	5′ 0 ″
8	7° 09′	575.618′	10° 02′	“	“	70′ 4½″	8′ 0″	5′ 3 ″
9	6° 22′	736.777′	7° 47′	“	“	75′ 9 ″	10′ 0″	6′ 4½″
10	5° 44′	925.594′	6° 12′	“	“	81′ 0½″	11′ 0″	7′ 1½″
11	5° 12′	1110.212′	5° 10′	1° 23′ 34″	18′ 0″	92′ 00 ″	12′ 0″	8′ 2 ″
12	4° 46′	1342.583′	4° 17′	“	“	97′ 3¼″	14′ 0″	8′ 9 ″

(Original.)

TABLE OF TURNOUTS FOR SPLIT SWITCHES AND SPRING FROGS. GAUGE 4′ 8½″.

(CURVE TANGENT TO SWITCH ANGLE AT HEEL OF SWITCH AND TO FROG ANGLE AT TOE OF FROG.)

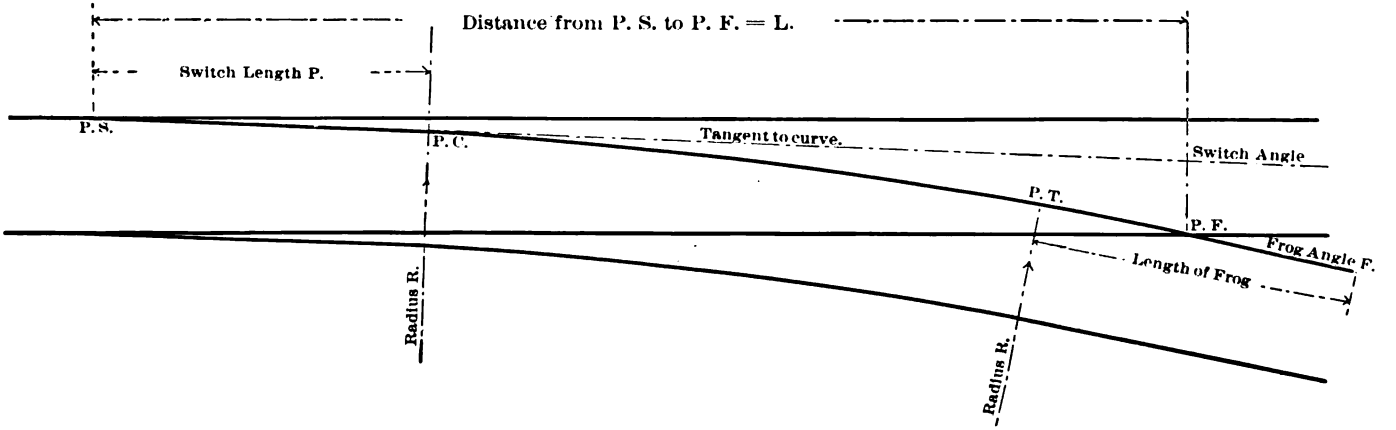


Table No 3.

Frog No. N.	Frog Angle F.	Radius of Curve R.	Degree of Curve D.	Switch Angle S.	Switch Length P.	Distance from Point of Switch to Actual Point of Frog L.	Length of Frog.	Length of Main Point of Frog.
8	7° 09′	418.21′	13° 44′	1° 23′ 34″	18′ 0″	69′ 1¼″	15′ 0″	6′ 0 ″
9	6° 22′	563.09′	10° 11′	1° 23′ 34″	18′ 0″	75′ 6¾″	15′ 0″	6′ 4½″
10	5° 44′	738.50′	7° 46′	1° 23′ 34″	18′ 0″	81′ 10½″	15′ 0″	7′ 0 ″

(Original.)

TABLE OF THREE-THROW TURNOUTS—STUB SWITCHES. GAUGE 4′ 8½″. THROW 5″.

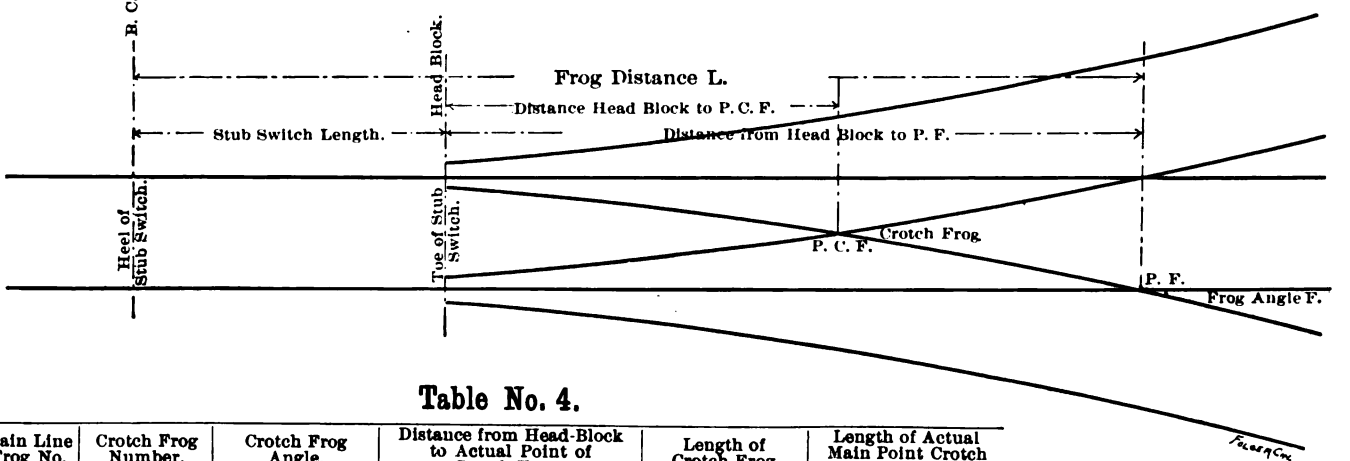


Table No. 4.

Main Line Frog No.	Crotch Frog Number.	Crotch Frog Angle.	Distance from Head-Block to Actual Point of Crotch Frog.	Length of Crotch Frog.	Length of Actual Main Point Crotch Frog.
4	2.82	20° 08′	15′ 7¾″	5′ 0″	3′ 5″
4½	3.17	17° 55′	17′ 6½″	5′ 0″	3′ 3″
5	3.53	16° 08′	19′ 5¾″	5′ 6″	3′ 6″
5½	3.88	14° 40′	21′ 4¾″	5′ 6″	3′ 6″
6	4.24	13° 28′	23′ 4″	6′ 0″	3′ 9″
6½	4.59	12° 26′	25′ 3¼″	6′ 0″	3′ 9″
7	4.94	11° 33′	27′ 2½″	6′ 0″	3′ 10″
7½	5.30	10° 47′	29′ 1¾″	6′ 6″	3′ 10½″
8	5.65	10° 07′	31′ 1″	6′ 6″	3′ 10½″
9	6.36	9° 00′	34′ 11¼″	7′ 0″	4′ 6″
10	7.07	8° 06′	38′ 9½″	7′ 0″	4′ 6½″
11	7.77	7° 22′	42′ 8¼″	8′ 0″	5′ 3″
12	8.48	6° 45′	46′ 6¾″	9′ 0″	5′ 11″

TABLE OF CROSSOVERS. GAUGE 4′ 8½″.

DISTANCES (C) BETWEEN ACTUAL POINTS OF FROGS MEASURED ALONG MAIN TRACK.

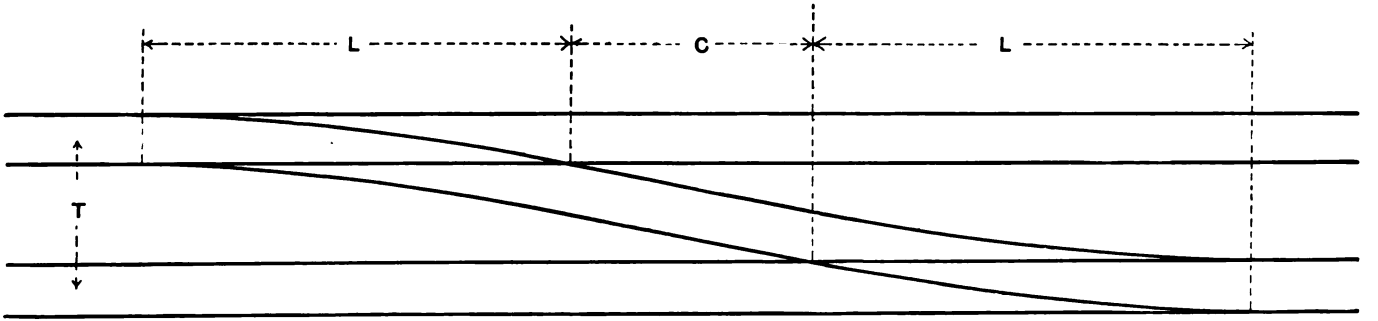


Table No. 5.

Frog Number.	Distance Between Track Centers—T.							
	11½ ft.	12 ft.	12½ ft.	13 ft.	13½ ft.	14 ft.	14½ ft.	15 ft.
6	11′ 7¾″	14′ 7½″	17′ 7¼″	20′ 7 ″	23′ 6¾″	26′ 6½″	29′ 6¼″	32′ 6 ″
6½	12′ 8¼″	15′ 11½″	19′ 1⅞″	22′ 4⅝″	25′ 7⅜″	28′ 10⅛″	32′ 1 ″	35′ 3¾″
7	13′ 8⅞″	17′ 2⅝″	20′ 8½″	24′ 2¼″	27′ 8 ″	31′ 1⅝″	34′ 7 ″	38′ 1⅜″
7½	14′ 9 ″	18′ 6 ″	22′ 3 ″	26′ 0 ″	29′ 8½″	33′ 5½″	37′ 2 ″	40′ 11 ″
8	15′ 9⅜″	19′ 9½″	23′ 9⅝″	27′ 9¼″	31′ 9 ″	35′ 8¾″	39′ 8½″	43′ 8⅜″
9	17′ 10½″	22′ 4¼″	26′ 10⅛″	31′ 4 ″	35′ 9⅞″	40′ 4⅝″	44′ 9½″	49′ 3⅜″
10	19′ 11⅝″	24′ 11 ″	29′ 10⅜″	34′ 10⅝″	39′ 10½″	44′ 10⅜″	49′ 10¼″	54′ 10⅛″
11	21′ 11¾″	27′ 5⅜″	32′ 11⅛″	39′ 5¼″	43′ 11⅞″	49′ 5 ″	54′ 10⅞″	60′ 4¾″
12	24′ 0¼″	30′ 0 ″	35′ 11⅞″	41′ 11¾″	47′ 11⅝″	53′ 11½″	59′ 11⅜″	65′ 11¼″

Original.

Table No. 6.

BILL OF TIES FOR SINGLE TURNOUTS, FIXED FROGS, 15′ SPLIT SWITCHES, 4′ 8½″ GAUGE.

NO. 6 FROG.	NO. 7 FROG.	NO. 8 FROG.	NO. 9 FROG.	NO. 10 FROG.
2 Head Blocks 7″ x 10″ x 16 ft. for High Stands.	2 Head Blocks 7″ x 10″ x 16 ft. for High Stands.	2 Head Blocks 7″ x 10″ x 16 ft. for High Stands.	2 Head Blocks 7″ x 10″ x 16 ft. for High Stands.	2 Head Blocks 7″ x 10″ x 16 ft. for High Stands.
2 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	2 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	2 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	2 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	2 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.
4 Ties 7″ x 9″ x 8½ ft.	5 Ties 7″ x 9″ x 8½ ft.	5 Ties 7″ x 9″ x 8½ ft.	5 Ties 7″ x 9″ x 8½ ft.	5 Ties 7″ x 9″ x 8½ ft.
4 " " 9 ft.	4 " " 9 ft.	4 " " 9 ft.	5 " " 9 ft.	5 " " 9 ft.
3 " " 9½ ft.	4 " " 9½ ft.	4 " " 9½ ft.	5 " " 9½ ft.	5 " " 9½ ft.
3 " " 10 ft.	3 " " 10 ft.	3 " " 10 ft.	4 " " 10 ft.	4 " " 10 ft.
3 " " 10½ ft.	3 " " 10½ ft.	3 " " 10½ ft.	3 " " 10½ ft.	4 " " 10½ ft.
2 " " 11 ft.	2 " " 11 ft.	3 " " 11 ft.	3 " " 11 ft.	4 " " 11 ft.
2 " " 11½ ft.	2 " " 11½ ft.	3 " " 11½ ft.	3 " " 11½ ft.	4 " " 11½ ft.
2 " " 12 ft.	2 " " 12 ft.	3 " " 12 ft.	3 " " 12 ft.	3 " " 12 ft.
1 " " 12½ ft.	2 " " 12½ ft.	3 " " 12½ ft.	3 " " 12½ ft.	3 " " 12½ ft.
*2 " 7″ x 10″ x 13 ft.	*2 " 7″ x 10″ x 13 ft.	*2 " 7″ x 10″ x 13 ft.	*3 " 7″ x 10″ x 13 ft.	*3 " 7″ x 10″ x 13 ft.
*2 " " 13½ ft.	*2 " " 13½ ft.	*2 " " 13½ ft.	*2 " " 13½ ft.	*3 " " 13½ ft.
1 " 7″ x 9″ x 14 ft.	2 " 7″ x 9″ x 14 ft.	2 " 7″ x 9″ x 14 ft.	2 " 7″ x 9″ x 14 ft.	2 " 7″ x 9″ x 14 ft.
2 " " 14½ ft.	2 " " 14½ ft.	2 " " 14½ ft.	2 " " 14½ ft.	2 " " 14½ ft.
1 " " 15 ft.	2 " " 15 ft.	2 " " 15 ft.	2 " " 15 ft.	3 " " 15 ft.
2 " " 15½ ft.	2 " " 15½ ft.	2 " " 15½ ft.	2 " " 15½ ft.	2 " " 15½ ft.
1 " " 16 ft.	1 " " 16 ft.	2 " " 16 ft.	2 " " 16 ft.	2 " " 16 ft.
1 " " 16½ ft.	1 " " 16½ ft.	2 " " 16½ ft.	2 " " 16½ ft.	2 " " 16½ ft.
1 " " 17 ft.	1 " " 17 ft.	1 " " 17 ft.	2 " " 17 ft.	2 " " 17 ft.
Total feet (B. M.) for Low Stands, 2444.542. High Stands, 2491.209.	Total feet (B. M.) for Low Stands, 2761.917. High Stands, 2808.584.	Total feet (B. M.) for Low Stands, 3174.542. High Stands, 3221.209.	Total feet (B. M.) for Low Stands, 3489.250. High Stands, 3535.917.	Total feet (B. M.) for Low Stands, 3740.875. High Stands, 3787.542.

*Frog Timbers. Spacing Ties under Frog and Switch 23″—Ties between, spaced 24″ Center to Center. (Original.)

Table No. 7.

BILL OF TIES FOR CROSSOVERS, NO. 6 FROGS, 15 FT. SPLIT SWITCHES, 4′ 8½″ GAUGE.

DISTANCES BETWEEN TRACK CENTERS.

12½ FEET.	13 FEET	13½ FEET.	14 FEET.
4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or
4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.
8 Ties 7″ x 9″ x 8½ ft.	8 Ties 7″ x 9″ x 8½ ft.	8 Ties 7″ x 9″ x 8½ ft.	8 Ties 7″ x 9″ x 8½ ft.
8 " " 9 ft.	8 " " 9 ft.	8 " " 9 ft.	8 " " 9 ft.
6 " " 9½ ft.	6 " " 9½ ft.	6 " " 9½ ft.	6 " " 9½ ft.
6 " " 10 ft.	6 " " 10 ft.	6 " " 10 ft.	6 " " 10 ft.
6 " " 10½ ft.	6 " " 10½ ft.	6 " " 10½ ft.	6 " " 10½ ft.
4 " " 11 ft.	4 " " 11 ft.	4 " " 11 ft.	4 " " 11 ft.
4 " " 11½ ft.	4 " " 11½ ft.	4 " " 11½ ft.	4 " " 11½ ft.
4 " " 12 ft.	4 " " 12 ft.	4 " " 12 ft.	4 " " 12 ft.
2 " " 12½ ft.	2 " " 12½ ft.	2 " " 12½ ft.	2 " " 12½ ft.
*8 " 7″ x 10″ x 21 ft.	*4 " 7″ x 10″ x 13 ft.	*4 " 7″ x 10″ x 13 ft.	*4 " 7″ x 10″ x 13 ft.
5 " 7″ x 9″ x 21 ft.	*4 " " 21½ ft.	*4 " " 22 ft.	*4 " " 13½ ft.
	6 " 7″ x 9″ x 21½ ft.	8 " 7″ x 9″ x 22 ft.	9 " 7″ x 9″ x 22½ ft.
Total feet (B. M.) for Low Stands, 4347.75. High Stands, 4441.08.	Total feet (B. M.) for Low Stands, 4298.75. High Stands, 4392.08.	Total feet (B. M.) for Low Stands, 4557.17. High Stands, 4650.50.	Total feet (B. M.) for Low Stands, 4497.958. High Stands, 4591.291.

*Frog Timbers.

Spacing of Ties under Frog and Switch 23″—Other Ties 24″ Center to Center. (Original.)

Table No. 8.

BILL OF TIES FOR CROSSOVERS, NO. 7 FROGS, 15 FT. SPLIT SWITCHES, 4′ 8½″ GAUGE.

DISTANCE BETWEEN TRACK CENTERS.

12½ FEET.	13 FEET.	13½ FEET.	14 FEET.
4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or 4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or 4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or 4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or 4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.
10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.
8 " " 9 ft.	8 " " 9 ft.	8 " " 9 ft.	8 " " 9 ft.
8 " " 9½ ft.	8 " " 9½ ft.	8 " " 9½ ft.	8 " " 9½ ft.
6 " " 10 ft.	6 " " 10 ft.	6 " " 10 ft.	6 " " 10 ft.
6 " " 10½ ft.	6 " " 10½ ft.	6 " " 10½ ft.	6 " " 10½ ft.
4 " " 11 ft.	4 " " 11 ft.	4 " " 11 ft.	4 " " 11 ft.
4 " " 11½ ft.	4 " " 11½ ft.	4 " " 11½ ft.	4 " " 11½ ft.
4 " " 12 ft.	4 " " 12 ft.	4 " " 12 ft.	4 " " 12 ft.
4 " " 12½ ft.	4 " " 12½ ft.	4 " " 12½ ft.	4 " " 12½ ft.
*8 " 7″ x 10″ x 21 ft.	*4 " 7″ x 10″ x 13 ft.	*4 " 7″ x 10″ x 13 ft.	*4 " 7″ x 10″ x 13 ft.
7 " 7″ x 9″ x 21 ft.	*4 " " 21½ ft.	*4 " " 13½ ft.	*4 " " 13½ ft.
	9 " 7″ x 9″ x 21½ ft.	10 " 7″ x 9″ x 22 ft.	12 " 7″ x 9″ x 22½ ft.
Total feet (B. M.) for Low Stands, 4898.50. High Stands, 4991.833.	Total feet (B. M.) for Low Stands, 4967.625. High Stands, 5060.958.	Total feet (B. M.) for Low Stands, 4920.083. High Stands, 5013.417.	Total feet (B. M.) for Low Stands, 5182.583. High Stands, 5275.916.

*Frog Timbers. **Spacing of Ties under Frog and Switch 23″—Other Ties 24″ Center to Center.** (Original.)

Table No. 9.

BILL OF TIES FOR CROSSOVERS, NO. 8 FROGS, 15 FT. SPLIT SWITCHES, 4′ 8½″ GAUGE.

DISTANCE BETWEEN TRACK CENTERS.

12½ FEET.	13 FEET.	13½ FEET.	14 FEET.
4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands, or
4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.
10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.
8 " " 9 ft.	8 " " 9 ft.	8 " " 9 ft.	8 " " 9 ft.
8 " " 9½ ft.	8 " " 9½ ft.	8 " " 9½ ft.	8 " " 9½ ft.
6 " " 10 ft.	6 " " 10 ft.	6 " " 10 ft.	6 " " 10 ft.
6 " " 10½ ft.	6 " " 10½ ft.	6 " " 10½ ft.	6 " " 10½ ft.
6 " " 11 ft.	6 " " 11 ft.	6 " " 11 ft.	6 " " 11 ft.
6 " " 11½ ft.	6 " " 11½ ft.	6 " " 11½ ft.	6 " " 11½ ft.
6 " " 12 ft.	6 " " 12 ft.	6 " " 12 ft.	6 " " 12 ft.
6 " " 12½ ft.	6 " " 12½ ft.	6 " " 12½ ft.	6 " " 12½ ft.
*8 " 7″ x 10″ x 21 ft.	*4 " 7″ x 10″ x 13 ft.	*4 " 7″ x 10″ x 13 ft.	*4 " 7″ x 10″ x 13 ft.
7 " 7″ x 9″ x 21 ft.	*4 " " 21½ ft.	*4 " " 13½ ft.	*4 " " 13½ ft.
	9 " 7″ x 9″ x 21½ ft.	11 " 7″ x 9″ x 22 ft.	13 " 7″ x 9″ x 22½ ft.
Total feet (B. M.) for Low Stands, 5382.000. High Stands, 5475.333.	Total feet (B. M.) for Low Stands, 5451.125. High Stands, 5544.458.	Total feet (B. M.) for Low Stands, 5519.08. High Stands, 5612.417.	Total feet (B. M.) for Low Stands, 5784.208. High Stands, 5877.541.

*Frog Timbers. Spacing of Ties under Frog and Switch 23″—Other Ties 24″ Center to Center. (Original.)

FRONT, SMITH AND WATER STREETS, CINCINNATI, OHIO.

Table No. 10.

BILL OF TIES FOR CROSSOVERS, NO. 9 FROG, 15 FT. SPLIT SWITCH, 4′ 8½″ GAUGE.

DISTANCE BETWEEN TRACK CENTERS.

12½ FEET.	13 FEET.	13½ FEET.	14 FEET.
4 Head Blocks 7″ x 10″ x 16 ft. for High Stands.	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands.	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands.	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands.
Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.
10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.
10 " " 9 ft.	10 " " 9 ft.	10 " " 9 ft.	10 " " 9 ft.
10 " " 9½ ft.	10 " " 9½ ft.	10 " " 9½ ft.	10 " " 9½ ft.
8 " " 10 ft.	8 " " 10 ft.	8 " " 10 ft.	8 " " 10 ft.
6 " " 10½ ft.	6 " " 10½ ft.	6 " " 10½ ft.	6 " " 10½ ft.
6 " " 11 ft.	6 " " 11 ft.	6 " " 11 ft.	6 " " 11 ft.
6 " " 11½ ft.	6 " " 11½ ft.	6 " " 11½ ft.	6 " " 11½ ft.
6 " " 12 ft.	6 " " 12 ft.	6 " " 12 ft.	6 " " 12 ft.
6 " " 12½ ft.	6 " " 12½ ft.	6 " " 12½ ft.	6 " " 12½ ft.
*10 " 7″ x 10″ x 21 ft.	*6 " 7″ x 10″ x 13 ft.	*6 " 7″ x 10″ x 13 ft.	*6 " 7″ x 10″ x 13 ft.
8 " 7″ x 9″ x 21 ft.	*4 " " 21½ ft.	*4 " " 13½ ft.	*4 " " 13½ ft.
	10 " 7″ x 9″ x 21½ ft.	12 " 7″ x 9″ x 22 ft.	15 " 7″ x 7″ x 22½ ft.
Total feet (B. M.) for High Stands, 6119.833. Low Stands, 6026.50.	Total feet (B. M.) for High Stands, 6108.250. Low Stands, 6014.917.	Total feet (B. M.) for High Stands, 6178.833. Low Stands, 6085.50.	Total feet (B. M.) for High Stands, 6564.708. Low Stands, 6471.375.

* Frog Timbers.

Spacing Ties under Frog and Switch 23″—Other Ties 24″ Center to Center.

(Original.)

Table No. 11.

BILL OF TIES FOR CROSSOVERS, NO. 10 FROGS, 15 FT. SPLIT SWITCHES, 4′ 8½″ GAUGE.

DISTANCE BETWEEN TRACK CENTERS.

12½ FEET.	13 FEET.	13½ FEET.	14 FEET.
4 Head Blocks 7″ x 10″ x 16 ft. for High Stands.	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands.	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands.	4 Head Blocks 7″ x 10″ x 16 ft. for High Stands.
4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.	4 Head Blocks 7″ x 10″ x 12 ft. for Low Stands.
10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.	10 Ties 7″ x 9″ x 8½ ft.
10 " " 9 ft.	10 " " 9 ft.	10 " " 9 ft.	10 " " 9 ft.
10 " " 9½ ft.	10 " " 9½ ft.	10 " " 9½ ft.	10 " " 9½ ft.
8 " " 10 ft.	8 " " 10 ft.	8 " " 10 ft.	8 " " 10 ft.
8 " " 10½ ft.	8 " " 10½ ft.	8 " " 10½ ft.	8 " " 10½ ft.
8 " " 11 ft.	8 " " 11 ft.	8 " " 11 ft.	8 " " 11 ft.
8 " " 11½ ft.	8 " " 11½ ft.	8 " " 11½ ft.	8 " " 11½ ft.
6 " " 12 ft.	6 " " 12 ft.	6 " " 12 ft.	6 " " 12 ft.
6 " " 12½ ft.	6 " " 12½ ft.	6 " " 12½ ft.	6 " " 12½ ft.
*12 " 7″ x 10″ x 21 ft.	*6 " 7″ x 10″ x 13 ft.	*6 " 7″ x 10″ x 13 ft.	*6 " 7″ x 10″ x 13 ft.
8 " 7″ x 9″ x 21 ft.	*6 " " 21½ ft.	*6 " " 13½ ft.	*6 " " 13½ ft.
	11 " 7″ x 9″ x 21½ ft.	13 " 7″ x 9″ x 22 ft.	15 " 7″ x 9″ x 22½ ft.
Total feet (B. M.) for Low Stands, 6627.25. High Stands, 6720.583.	Total feet (B. M.) for Low Stands, 6723.875. High Stands, 6817.208.	Total feet (B. M.) for Low Stands, 6704.25. High Stands, 6797.583.	Total feet (B. M.) for Low Stands, 6974.625. High Stands ,7067.958.

*Frog Timbers. **Spacing Ties under Frog and Switch 23″—Other Ties 24″ Center to Center.** (Original.)

Table No. 12.

BILL OF TIES, COMBINATION CROSSINGS OR DOUBLE SLIP SWITCHES, DESIGN NO. 2.

NO. 6 COMBINATION.	NO. 7 COMBINATION.	NO. 8 COMBINATION.	NO. 9 COMBINATION.
*2 Ties 7″ x 10″ x 13 ft.	*2 Ties 7″ x 10″ x 13 ft.	*2 Ties 7″ x 10″ x 13 ft.	*2 Ties 7″ x 10″ x 13 ft.
2 " " 10½ ft.	2 " " 10½ ft.	2 " " 10½ ft.	2 " " 10½ ft.
*2 " " 12 ft.	*2 " " 12 ft.	*2 " " 12 ft.	*2 " " 12 ft.
2 " " 10½ ft.	4 " " 10½ ft.	6 " " 10½ ft.	8 " " 10½ ft.
*2 " " 12 ft.	*2 " " 12 ft.	*2 " " 12 ft.	*2 " " 12 ft.
2 " " 11 ft.	2 " " 10½ ft.	2 " " 10½ ft.	2 " " 10½ ft.
*2 " " 12 ft.	*2 " " 12 ft.	*2 " " 12 ft.	*2 " " 12 ft.
2 " " 11 ft.	4 " " 11 ft.	6 " " 11 ft.	6 " " 11 ft.
*6 " " 12½ ft.	*6 " " 12½ ft.	*6 " " 12½ ft.	*6 " " 12½ ft.
2 " " 11½ ft.	2 " " 11½ ft.	2 " " 11½ ft.	4 " " 11½ ft.
4 " " 12 ft.	4 " " 12 ft.	4 " " 12 ft.	6 " " 12 ft.
4 " " 12½ ft.	4 " " 12½ ft.	4 " " 12½ ft.	4 " " 12½ ft.
2 " " 13 ft.	4 " " 13 ft.	4 " " 13 ft.	6 " " 13 ft.
2 " " 13½ ft.	2 " " 13½ ft.	4 " " 13½ ft.	4 " " 13½ ft.
4 " " 14 ft.	4 " " 14 ft.	6 " " 14 ft.	6 " " 14 ft.
2 " " 14½ ft.	4 " " 14½ ft.	4 " " 14½ ft.	4 " " 14½ ft.
4 " " 15 ft.	4 " " 15 ft.	4 " " 15 ft.	4 " " 15 ft.
2 " " 15½ ft.	4 " " 15½ ft.	4 " " 15½ ft.	4 " " 15½ ft.
4 " " 16 ft.	4 " " 16 ft.	4 " " 16 ft.	4 " " 16 ft.
4 " " 16½ ft.	4 " " 16½ ft.	4 " " 16½ ft.	4 " " 16½ ft.
Total feet (B. M.) in the 56 pieces, 4010.833.	Total feet (B. M.) in the 66 pieces, 4763.333.	Total feet (B. M.) in the 74 pieces, 5315.000.	Total feet (B. M.) in the 82 pieces, 5863.333.

* Ties for Stands and Pipe Carriers.

All Timbers Spaced 22″ Center to Center.

(Original.)

Lengths.	END SIZES OF CROSS TIES.							
	6" x 8"	6" x 9"	6" x 10"	7" x 8"	7" x 9"	7" x 10"	8" x 10"	8" x 12"
8'	32.000	36.000	40.000	37.333	42.000	46.667	53.333	64.000
8½'	34.000	38.250	42.500	39.667	44.625	49.583	56.667	68.000
9'	36.000	40.500	45.000	42.000	47.250	52.500	60.000	72.000
9½'	38.000	42.750	47.500	44.333	49.875	55.417	63.333	76.000
10'	40.000	45.000	50.000	46.337	52.500	58.333	66.667	80.000
10½'	42.000	47.250	52.500	49.000	55.125	61.250	70.000	84.000
11'	44.000	49.500	55.000	51.333	57.750	64.167	73.333	88.000
11½'	46.000	51.750	57.500	53.667	60.375	67.083	76.667	92.000
12'	48.000	54.000	60.000	56.000	63.000	70.000	80.000	96.000
12½'	50.000	56.250	62.500	58.333	65.625	72.917	83.333	100.000
13'	52.000	58.500	65.000	60.667	68.250	75.833	86.667	104.000
13½'	54.000	60.750	67.500	63.000	70.875	78.750	90.000	108.000
14'	56.000	63.000	70.000	65.333	73.500	81.667	93.333	112.000
14½'	58.000	65.250	72.500	67.667	76.125	84.583	96,667	116.000
15'	60.000	67.500	75.000	70.000	78.750	87.500	100.000	120.000
15½'	62.000	69.750	77.500	72.333	81.375	90.417	103.333	124.000
16'	64.000	72.000	80.000	74.667	84.000	93.333	106.667	128.000
16½'	66.000	74.250	82.500	77.000	86.625	96.250	110.000	132.000
17'	68.000	76.500	85.000	79.333	89.250	99.167	113.333	136.000
17½'	70.000	78.750	87.500	81.667	91.875	102.083	116.667	140.000
18'	72.000	81.000	90.000	84.000	94.500	105.000	120.000	144.000
18½'	74.000	83.250	92.500	86.333	97.125	107.917	123.333	148.000
19'	76.000	85.500	95.000	88.667	99.750	110.833	126.667	152.000
19½'	78.000	87.750	97.500	90.000	102.375	113.750	130.000	156.000
20'	80.000	90.000	100.000	93.333	105.000	116.667	133.333	160.000
20½'	82.000	92.250	102.500	95.667	107.625	119.583	136.667	164.000
21'	84.000	94.500	105.000	98.000	110.250	122.500	140.000	168.000
21½'	86.000	96.750	107.500	100.333	112.875	125.417	143.333	172.000
22'	88.000	99.000	110.000	102.667	115.500	128.333	146.667	176.000
22½'	90.000	101.250	112.500	105.000	118.125	131.250	150.000	180.000
23'	92.000	103.500	115.000	107.333	120.750	134.157	153.333	184.000
23½'	94.000	105.750	117.500	109.667	123.375	137.083	156.667	188.000
24'	96.000	108.000	120.000	112.000	126.000	140.000	160.000	192.000
24½'	98.000	110.250	122.500	114.333	128.625	142.917	163.333	196.000
25'	100.000	112.500	125.000	116.667	131.250	145.833	166.667	200.000
25½'	102.000	114.750	127.500	119.000	133.875	148.750	170.000	204.000

TOTAL FEET (BOARD MEASURE) IN CROSS-TIES PER MILE OF TRACK.

Table No. 14.

DISTANCE CENTER TO CENTER.	NUMBER OF TIES PER MILE.	Sizes of Cross-Ties.						
		6″ x 8″ x 8 ft.	7″ x 8″ x 8 ft.	7″ x 8″ x 8½ ft.	7″ x 9″ x 8½ ft.	7″ x 10″ x 8½ ft.	7″ x 9″ x 9 ft.	7″ x 10″ x 9 ft.
18″	3520	112640	131413.33	139626.67	157080.	173946.67	166320.	184800.
21″	3017	96544	112634.67	119674.33	134533.63	149090.08	142553.25	158392.5
24″	2640	84480	98560.	104720.	117810.	130460.	131740.	138600.
27″	2348	75136	87658.67	93137.33	104779.5	116030.33	110943.	123870.
30″	2113	67616	78885.33	83815.67	94292.63	104417.42	99839.33	110932.5

Table No. 15.

TONS OF RAILS REQUIRED PER MILE OF TRACK.		NUMBER OF PAIRS OF ANGLE BARS REQUIRED TO THE TON OF RAILS.					
Weight of Rail. Per Yard.	Weight Per Mile of Track.	Weight of Rail per yd.	24 Ft. Rail.	25 Ft. Rail.	26 Ft. Rail.	27 Ft. Rail.	28 Ft. Rail.	30 Ft. Rail.
16 lbs.	25.142857 gross tons.	Pounds.	Joints.	Joints.	Joints.	Joints.	Joints.	Joints.
20 "	31.428571 "							
25 "	39.285714 "	30	9.33	8.95	8.61	8.29	8.00	7.46
30 "	47.142857 "	35	8.00	7.67	7.38	7.10	6.85	6.40
35 "	55.000000 "	40	7.00	6.71	6.45	6.22	5.99	5.60
40 "	62.857142 "	45	6.22	5.96	5.74	5.52	5.33	4.97
45 "	70.714285 "	50	5.60	5.37	5.16	4.97	4.79	4.48
50 "	78.571428 "	56	5.00	4.79	4.61	4.44	4.28	4.00
52 "	81.714285 "	60	4.66	4.47	4.30	4.14	4.00	3.73
56 "	88.000000 "	62	4.51	4.33	4.16	4.01	3.86	3.61
60 "	94.285714 "	67	4.17	4.00	3.85	3.71	3.58	3.34
62 "	97.428571 "	68	4.12	3.95	3.79	3.67	3.53	3.29
65 "	102.142857 "	70	4.00	3.84	3.69	3.56	3.43	3.20
67 "	105.285714 "	72	3.89	3.73	3.58	3.46	3.33	3.11
68 "	106.857142 "	75	3.73	3.58	3.45	3.32	3.20	2.99
70 "	110.000000 "	80	3.50	3.35	3.23	3.11	2.99	2.80
72 "	113.142857 "	85	3.29	3.16	3.10	2.93	2.83	2.64
75 "	117.857142 "	90	3.11	2.98	2.76	2.76	2.67	2.49
80 "	125.714285 "							
85 "	133.571428 "							
90 "	141.428571 "							

Table No. 16.

RAILROAD SPIKES.

Size measured under head.	Average Number per keg of 200 pounds.	Ties two feet between centers, four spikes per ties, makes per mile.	Rail used, weight per yard.
Inches.		Pounds. Kegs.	
$5\frac{1}{2} \times \frac{9}{16}$	373	5670=29	45 to 70
$5 \times \frac{9}{16}$	400	5170=26	40 to 56
$5 \times \frac{1}{2}$	453	4660=24	35 to 40
$4\frac{1}{2} \times \frac{1}{2}$	533	3960=20	30 to 35
$4 \times \frac{1}{2}$	600	3520=18	28 to 35
$4\frac{1}{2} \times \frac{7}{16}$	670	3110=16	25 to 30
$4 \times \frac{7}{16}$	720	2940=15	
$3\frac{1}{2} \times \frac{7}{16}$	900	2350=12	20 to 25
$4 \times \frac{3}{8}$	1013	2090=11	
$3\frac{1}{2} \times \frac{3}{8}$	1187	1780= 9	16 to 20
$3 \times \frac{3}{8}$	1240	1710= 9	

FISH-PLATES AND BOLTS PER MILE OF TRACK.

Length of Rail. Feet.	Number of Fish-Plates Required.	Number of Bolts.	Number of Rails or Complete Joints.
24	880	1760	440
25	844	1688	422
26	812	1624	406
27	782	1564	391
28	754	1508	377
30	704	1408	352

TABLE OF MIDDLE ORDINATES IN INCHES FOR CURVING RAILS.

Table No. 17. LENGTH OF RAILS IN FEET.

Def. Angle.	Radius in Feet.	30	28	26	24	22	20	18	16	14	12	10	8	6
0°30′	11460.	1/8″	3/32″	5/64″	1/16″	3/64″	3/64″	1/32″	1/32″	1/32″	1/64″	1/64″		
1°00′	5730.	1/4″	3/16″	5/32″	9/64″	7/64″	3/32″	5/64″	1/16″	3/64″	1/32″	1/32″	1/64″	1/64″
1°30′	3820.	11/32″	5/16″	1/4″	7/32″	3/16″	5/32″	1/8″	3/32″	5/64″	3/64″	1/32″	1/32″	1/64″
2°00′	2865.	29/64″	13/32″	11/32″	19/64″	1/4″	13/64″	11/64″	9/64″	3/32″	5/64″	3/64″	1/32″	1/64″
2°30′	2292.	19/32″	33/64″	29/64″	3/8″	21/64″	17/64″	7/32″	11/64″	1/8″	3/32″	1/16″	1/32″	1/32″
3°00′	1910.	11/16″	39/64″	17/32″	7/16″	3/8″	5/16″	17/64″	13/64″	9/64″	7/64″	5/64″	3/64″	1/32″
3°30′	1637.	27/32″	23/32″	5/8″	33/64″	7/16″	3/8″	19/64″	1/4″	3/16″	9/64″	3/32″	1/16″	1/32″
4°00′	1433.	61/64″	53/64″	23/32″	19/32″	1/2″	27/64″	11/32″	9/32″	7/32″	5/32″	7/64″	5/64″	1/32″
4°30′	1274.	1 1/16″	29/32″	13/16″	43/64″	9/16″	15/32″	1/4″	5/16″	1/4″	3/16″	1/8″	3/64″	3/64″
5°00′	1146.	1 3/16″	1 1/32″	57/64″	3/4″	5/8″	17/32″	27/64″	11/32″	17/64″	3/16″	1/8″	3/32″	3/64″
5°30′	1042.	1 9/32″	1 1/8″	1″	27/32″	23/32″	9/16″	15/32″	3/8″	9/32″	7/32″	9/64″	3/32″	3/64″
6°00′	955.4	1 13/32″	1 3/32″	1 1/16″	29/32″	25/32″	5/8″	1/2″	13/32″	5/16″	1/4″	5/32″	3/32″	1/16″
6°30′	882.	1 17/32″	1 1/32″	1 5/32″	1″	13/16″	11/16″	9/16″	7/16″	11/32″	1/4″	11/64″	7/64″	1/16″
7°00′	819.	1 21/32″	1 7/32″	1 1/4″	1 1/16″	7/8″	3/4″	19/32″	15/32″	3/8″	1/4″	3/16″	1/8″	1/16″
7°30′	764.5	1 3/4″	1 11/32″	1 1/32″	1 1/8″	15/16″	25/32″	5/8″	1/2″	3/8″	9/32″	3/16″	1/8″	5/64″
8°00′	716.8	1 29/32″	1 21/32″	1 7/16″	1 3/16″	1 1/32″	27/32″	21/32″	17/32″	13/32″	19/64″	13/64″	9/64″	5/64″
8°30′	674.6	2″	1 3/4″	1 1/2″	1 9/32″	1 3/32″	7/8″	23/32″	9/16″	7/16″	5/16″	7/32″	9/64″	3/32″
9°00′	637.3	2 3/32″	1 25/32″	1 19/32″	1 11/32″	1 1/8″	15/16″	3/4″	19/32″	15/32″	3/8″	1/4″	9/64″	3/32″

Table from Trautwine, modified by changing Ordinates into inches.

TABLE OF MIDDLE ORDINATES IN INCHES FOR CURVING RAILS.

Table No. 17—Continued. LENGTH OF RAILS IN FEET.

Def. Angle.	Radius in Feet.	30	28	26	24	22	20	18	16	14	12	10	8	6
9°30′	603.8	2 1/4″	1 15/16″	1 11/16″	1 7/16″	1 7/32″	1 ″	13/16″	21/32″	1/2″	3/8″	1/4″	5/32″	3/32″
10°	573.7	2 1/32″	2 1/16″	1 25/32″	1 1/2″	1 9/32″	1 9/64″	27/32″	11/16″	1/32″	25/64″	17/64″	11/64″	3/32″
11°	521.7	2 1/32″	2 1/16″	1 13/16″	1 1/16″	1 1/32″	1 5/32″	1 5/16″	3/4″	1 9/32″	7/16″	5/16″	13/64″	7/64″
12°	478.3	2 1/16″	2 1/32″	2 5/32″	1 13/16″	1 1/32″	1 1/4″	1 1/32″	13/16″	5/8″	15/32″	5/16″	13/64″	1/8″
13°	441.7	3 1/16″	2 31/32″	2 5/16″	1 15/16″	1 3/4″	1 1/32″	1 3/32″	29/32″	11/16″	1/2″	11/32″	1/4″	1/8″
14°	410.3	3 9/32″	2 7/8″	2 31/32″	2 3/32″	1 25/32″	1 15/32″	1 1/16″	31/32″	23/32″	17/32″	3/8″	1/4″	1/8″
15°	383.1	3 17/32″	3 3/32″	2 1/16″	2 1/4″	1 29/32″	1 9/16″	1 9/32″	1 ″	25/32″	19/32″	13/32″	1/4″	9/64″
16°	359.3	3 3/4″	3 9/32″	2 13/16″	2 1/32″	2 1/32″	1 21/32″	1 1/32″	1 3/32″	27/32″	5/8″	7/16″	9/32″	5/32″
17°	338.3	4 ″	3 1/2″	3 1/32″	2 9/16″	2 5/32″	1 25/32″	1 7/16″	1 5/32″	7/8″	21/32″	7/16″	9/32″	11/64″
18°	319.6	4 7/32″	3 21/32″	3 3/16″	2 1/16″	2 9/32″	1 7/8″	1 17/32″	1 7/32″	15/16″	11/16″	15/32″	19/64″	11/64″
19°	302.9	4 7/16″	3 7/8″	3 3/8″	2 7/8″	2 7/16″	2 ″	1 5/8″	1 5/16″	1 ″	3/4″	1/2″	5/16″	3/16″
20°	287.9	4 11/16″	4 3/32″	3 9/16″	3 ″	2 9/16″	2 3/32″	1 11/16″	1 3/8″	1 1/32″	25/32″	17/32″	11/32″	3/16″
21°	274.4	4 15/16″	4 9/32″	3 23/32″	3 5/32″	2 21/32″	2 3/16″	1 25/32″	1 7/16″	1 3/32″	13/16″	9/16″	3/8″	3/16″
22°	262.	5 5/32″	4 1/2″	3 31/32″	3 5/16″	2 13/16″	2 9/32″	1 27/32″	1 1/2″	1 5/32″	7/8″	9/16″	3/8″	7/32″
23°	250.8	5 13/32″	4 1/16″	4 1/16″	3 7/16″	2 29/32″	2 3/8″	1 15/16″	1 9/16″	1 1/8″	29/32″	19/32″	25/64″	13/64″
24°	240.5	5 5/8″	4 29/32″	4 1/4″	3 13/32″	3 1/32″	2 1/2″	2 1/32″	1 31/32″	1 1/4″	15/16″	5/8″	13/32″	7/32″
25°	231.	5 13/16″	5 3/32″	4 13/32″	3 3/4″	3 5/32″	2 9/32″	2 1/8″	1 23/32″	1 9/32″	31/32″	21/32″	7/16″	1/4″

Table from Trautwine, modified by changing Ordinates into inches.

Table No. 18.

DECIMAL PARTS OF A FOOT FOR EACH $\frac{1}{64}$ OF AN INCH.

(Trautwine.)

Inch.	0″	1″	2″	3″	4″	5″	6″	7″	8″	9″	10″	11″
0	.0	.083	.167	.250	.333	.417	.500	.583	.667	.750	.833	.917
$\frac{1}{64}$	.001	.085	.168	.251	.335	.418	.501	.585	.668	.751	.835	.918
$\frac{1}{32}$	.003	.086	.169	.253	.336	.419	.503	.586	.669	.753	.836	.919
$\frac{3}{64}$	.004	.087	.171	.254	.337	.421	.504	.587	.671	.754	.837	.921
$\frac{1}{16}$	.005	.089	.172	.255	.339	.422	.505	.589	.672	.755	.839	.922
$\frac{5}{64}$	.007	.090	.173	.257	.340	.423	.507	.590	.673	.757	.840	.923
$\frac{3}{32}$	.008	.091	.175	.258	.341	.424	.508	.591	.675	.758	.841	.925
$\frac{7}{64}$	.009	.092	.176	.259	.342	.426	.509	.592	.676	.759	.842	.926
$\frac{1}{8}$	.010	.094	.177	.260	.344	.427	.510	.594	.677	.760	.844	.927
$\frac{9}{64}$	.012	.095	.178	.262	.345	.428	.512	.295	.678	.762	.845	.928
$\frac{5}{32}$	.013	.096	.180	.263	.346	.430	.513	.596	.680	.763	.846	.930
$\frac{11}{64}$	.014	.098	.181	.264	.348	.431	.514	.598	.681	.764	.848	.931
$\frac{3}{16}$	.015	.099	.182	.266	.349	.432	.516	.599	.682	.766	.849	.932
$\frac{13}{64}$	.017	.100	.184	.267	.350	.434	.517	.600	.684	.767	.850	.934
$\frac{7}{32}$	.018	.102	.185	.268	.352	.435	.518	.602	.685	.768	.852	.935
$\frac{15}{64}$	.020	.103	.186	.270	.353	.436	.520	.603	.686	.770	.853	.936
$\frac{1}{4}$	.021	.104	.188	.271	.354	.438	.521	.604	.688	.771	.854	.938
$\frac{17}{64}$	.022	.106	.189	.272	.356	.439	.522	.606	.689	.772	.856	.939
$\frac{9}{32}$	.023	.107	.190	.273	.357	.440	.523	.607	.690	.773	.857	.940
$\frac{19}{64}$	.025	.108	.191	.275	.358	.441	.525	.608	.691	.775	.858	.941
$\frac{5}{16}$	.026	.109	.193	.276	.359	.443	.526	.609	.693	.776	.859	.943
$\frac{21}{64}$	.027	.111	.194	.277	.361	.444	.527	.611	.694	.777	.861	.944
$\frac{11}{32}$	.029	.112	.195	.279	.362	.445	.529	.612	.695	.779	.862	.945
$\frac{23}{64}$	.030	.113	.197	.280	.363	.447	.530	.613	.697	.780	.863	.946
$\frac{3}{8}$	.031	.115	.198	.281	.365	.448	.531	.615	.698	.781	.865	.948
$\frac{25}{64}$	.033	.116	.199	.283	.366	.450	.533	.616	.699	.783	.866	.949
$\frac{13}{32}$	.034	.117	.201	.284	.367	.451	.534	.617	.701	.784	.867	.951
$\frac{27}{64}$	.035	.119	.202	.285	.369	.452	.535	.619	.702	.785	.869	.952
$\frac{7}{16}$	.037	.120	.203	.286	.370	.453	.536	.620	.703	.787	.870	.953
$\frac{29}{64}$	.038	.121	.204	.288	.371	.454	.538	.621	.704	.788	.871	.954
$\frac{15}{32}$	.039	.122	.206	.289	.372	.456	.539	.622	.706	.789	.872	.956
$\frac{31}{64}$	.040	.124	.207	.290	.374	.457	.540	.624	.707	.790	.874	.957
$\frac{1}{2}$	.042	.125	.208	.292	.375	.458	.542	.625	.708	.792	.875	.958
	0″	1″	2″	3″	4″	5″	6″	7″	8″	9″	10″	11″

Table No. 18—Continued.

DECIMAL PARTS OF A FOOT FOR EACH $\frac{1}{64}$ OF AN INCH.

(Trautwine.)

Inch.	0″	1″	2″	3″	4″	5″	6″	7″	8″	9″	10″	11″
$\frac{33}{64}$	.043	.126	.210	.293	.376	.460	.543	.626	.710	.793	.876	.960
$\frac{17}{32}$	.044	.128	.211	.294	.378	.461	.544	.628	.711	.794	.878	.961
$\frac{35}{64}$	.046	.129	.212	.296	.379	.462	.546	.629	.712	.796	.879	.962
$\frac{9}{16}$	.047	.130	.214	.297	.380	.464	.547	.630	.714	.797	.880	.964
$\frac{37}{64}$	.048	.132	.215	.298	.382	.465	.548	.632	.715	.798	.882	.965
$\frac{19}{32}$	.050	.133	.216	.300	.383	.466	.550	.633	.716	.800	.883	.966
$\frac{39}{64}$	.051	.134	.217	.301	.384	.467	.551	.634	.717	.801	.884	.967
$\frac{5}{8}$	.052	.135	.219	.302	.385	.469	.552	.635	.719	.802	.885	.969
$\frac{41}{64}$	.053	.137	.220	.303	.387	.470	.553	.637	.720	.803	.887	.970
$\frac{21}{32}$	.055	.138	.221	.305	.388	.471	.555	.638	.721	.805	.888	.971
$\frac{43}{64}$	.056	.139	.223	.306	.389	.473	.556	.639	.723	.806	.889	.973
$\frac{11}{16}$	.057	.141	.224	.307	.391	.474	.557	.641	.724	.807	.891	.974
$\frac{45}{64}$	.059	.142	.225	.309	.392	.475	.559	.642	.725	.809	.892	.975
$\frac{23}{32}$	.060	.143	.227	.310	.393	.477	.560	.643	.727	.810	.893	.977
$\frac{47}{64}$	.061	.145	.228	.311	.395	.478	.561	.645	.728	.811	.895	.978
$\frac{3}{4}$	.063	.146	.229	.313	.396	.479	.563	.646	.729	.813	.896	.979
$\frac{49}{64}$	.064	.147	.231	.314	.397	.480	.564	.647	.731	.814	.897	.981
$\frac{25}{32}$	.065	.148	.232	.315	.398	.482	.565	.648	.732	.815	.898	.982
$\frac{51}{64}$	.066	.150	.233	.316	.400	.483	.566	.650	.733	.816	.900	.983
$\frac{13}{16}$	.068	.151	.234	.318	.401	.484	.568	.651	.734	.818	.901	.984
$\frac{53}{64}$	.069	.152	.236	.319	.402	.486	.569	.652	.736	.819	.902	.986
$\frac{27}{32}$	.070	.154	.237	.320	.404	.487	.570	.654	.737	.820	.904	.987
$\frac{55}{64}$	.072	.155	.238	.322	.405	.488	.572	.655	.738	.822	.905	.988
$\frac{7}{8}$	.073	.156	.240	.323	.406	.490	.573	.656	.740	.823	.906	.990
$\frac{57}{64}$	.074	.158	.241	.324	.408	.491	.574	.658	.741	.824	.908	.991
$\frac{29}{32}$	.076	.159	.242	.326	.409	.492	.576	.659	.742	.826	.909	.992
$\frac{59}{64}$	.077	.160	.244	.327	.410	.494	.577	.660	.744	.827	.910	.994
$\frac{15}{16}$	.078	.162	.245	.328	.412	.495	.578	.662	.745	.828	.912	.995
$\frac{61}{64}$	.079	.163	.246	.329	.413	.496	.579	.663	.746	.829	.913	.996
$\frac{31}{32}$	.081	.164	.247	.331	.414	.497	.580	.664	.747	.831	.914	.997
$\frac{63}{64}$	.082	.165	.249	.332	.415	.499	.582	.665	.749	.832	.915	.999
1												1.000
	0″	1″	2″	3″	4″	5″	6″	7″	8″	9″	10″	11″

Table No. 19.

DECIMALS OF AN INCH FOR EVERY $\frac{1}{64}$TH.

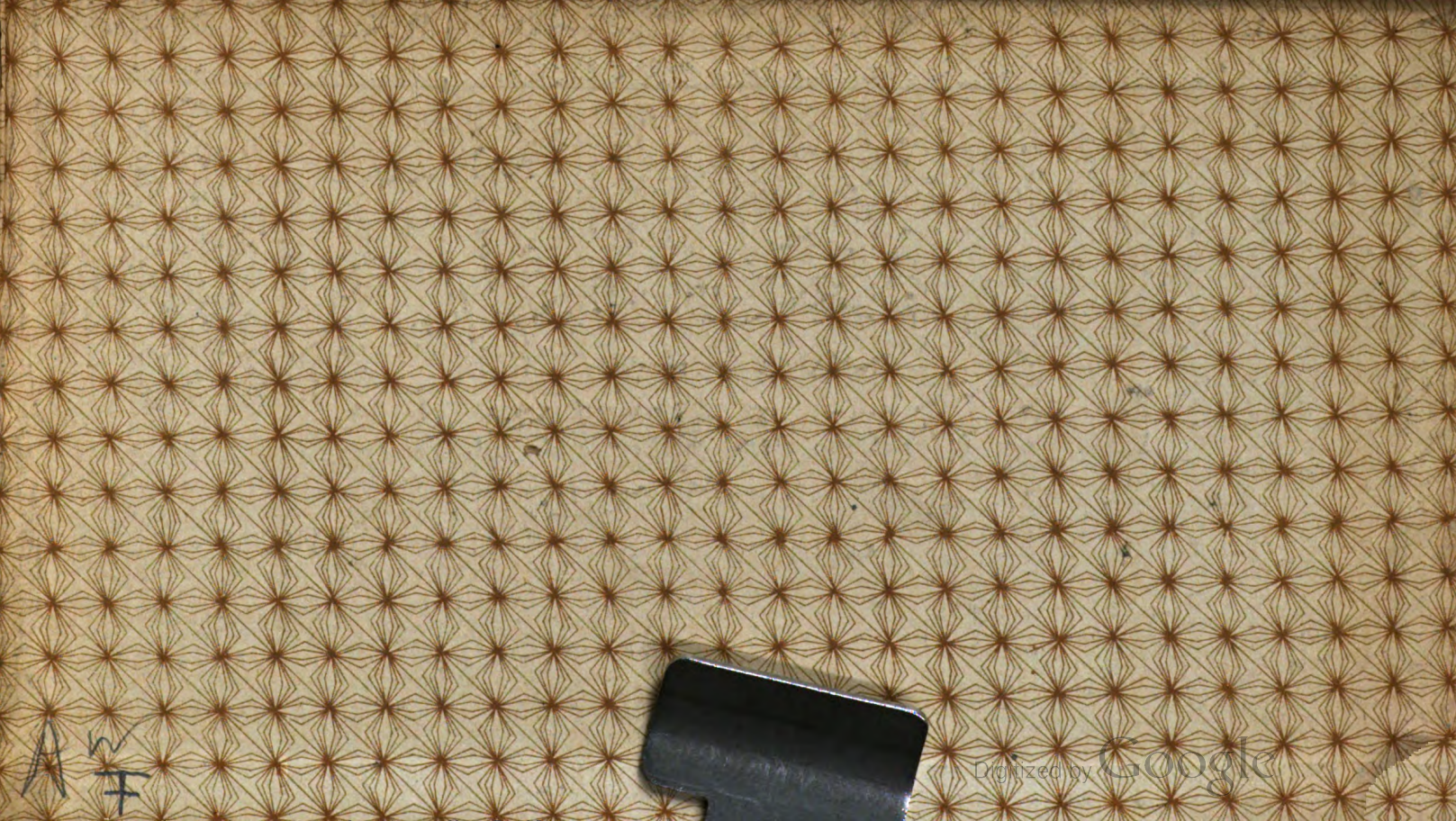
(Trautwine.)

$\frac{1}{4}$″	$\frac{1}{8}$″	$\frac{1}{16}$″	$\frac{1}{32}$″	$\frac{1}{64}$″	Decimal	$\frac{1}{4}$″	$\frac{1}{8}$″	$\frac{1}{16}$″	$\frac{1}{32}$″	$\frac{1}{64}$″	Decimal
				1	.015625					33	.515625
			1		.03125				17		.53125
				3	.046875					35	.546875
		1			.0625			9			.5625
				5	.078125					37	.578125
			3		.09375				19		.59375
				7	.109375					39	.609375
	1				.125		5				.625
				9	.140625					41	.640625
			5		.15625				21		.65625
				11	.171875					43	.671875
		3			.1875			11			.6875
				13	.203125					45	.703125
			7		.21875				23		.71875
				15	.234375					47	.734375
1					.25	3					.75
				17	.265625					49	.765625
			9		.28125				25		.78125
				19	.296875					51	.796875
		5			.3125			13			.8125
				21	.328125					53	.828125
			11		.34375				27		.84375
				23	.359375					55	.859375
	3				.375		7				.875
				25	.390625					57	.890625
			13		.40625				29		.90625
				27	.421875					59	.921875
		7			.4375			15			.9375
				29	.453125					61	.953125
			15		.46875				31		.96875
				31	.484375					63	.984375
2					.5	4					1.000000

Table No. 20.

RAIL SECTIONS CARRIED IN STOCK BY THE WEIR FROG CO.

Height.	Weight.	Cambria.	Edgar Thomson.	Miscellaneous Mills.
2¼″	16 pounds.	Section No. 121		
2⅜″	20 "	" 122		
2½″	25 "	" 104		
3″	30 "	" 71		
3 1/16″	35 "	" 81		
3¼″	40 "	" 90		
3⅜″	45 "	" 148		
3½″	50 "	" 60		Lackawana.
4″	50 "	" 100	Section No. 150	
4″	52 "	" 109		
4″	56 "	" 63	" 135	
4″	58¼ "	" 54	" 120	
4″	60 "	" 95	" 112	
4¼″	56 "	" 73	" 130	
4¼″	60 "	" 56	" 110	
4¼″	60 "	" 99		
4¼″	60 "		" 113	Bethlehem and Scranton.
4¼″	61½ "		" 95	Lackawanna.
4 5/16″	60½ "	" 65	" 105	Bethlehem.
4½″	67 "	" 55	" 50	Bethlehem and Lackawanna.
4½″	68 "		" 51	
4½″	70 "	" 155		
4½″	70 "	" 125	" 40	
4⅝″	75 "		" 30	
4¾″	75 "			Illinois Steel Co., No. 7503.
4¾″	75 "		" 32	
5″	80 "		" 21	
5″	85 "	" 146	" 10	
5″	85 "	" 163	" 11	
5″	90 "			Illinois Steel Co., No. 9001.



The Weir Frog Co.

MANUFACTURERS OF

Frogs, Switches, Crossings, Etc.

CINCINNATI, OHIO.

1893.